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electrical contracting

Maintenance Section

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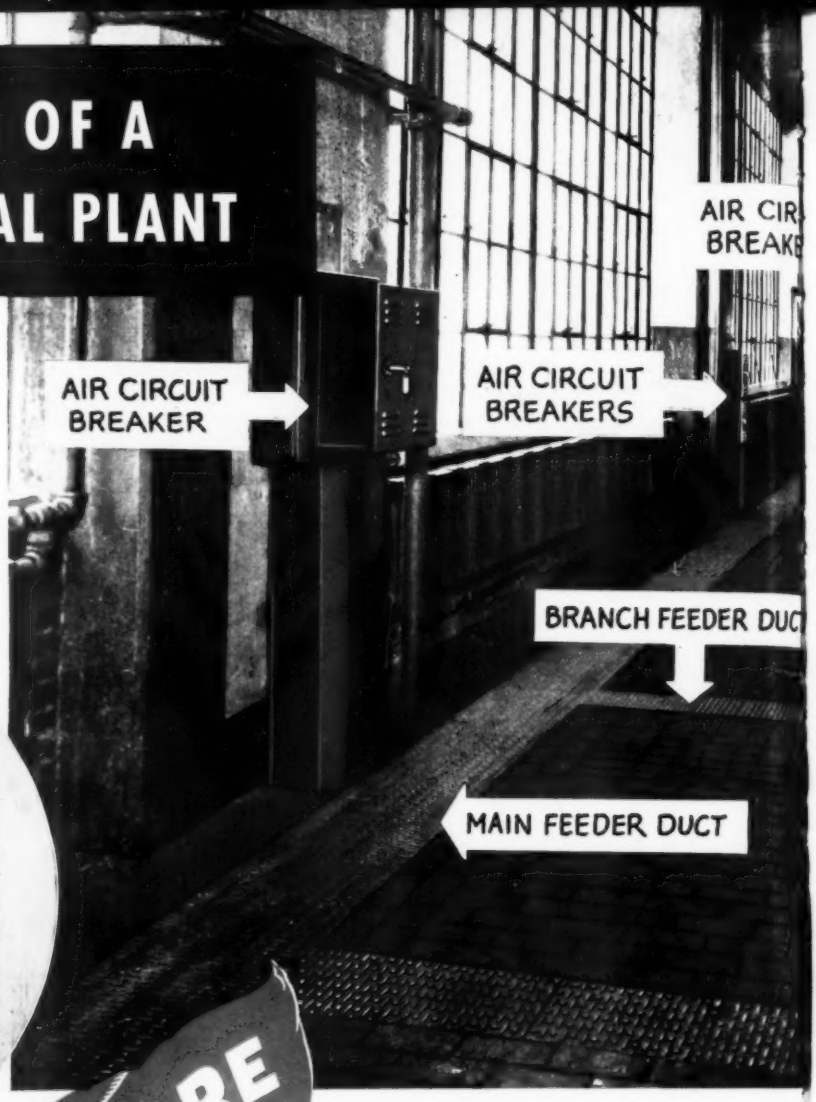
JULY · 1939

ELECTRICAL CONTRACTING • INSTALLATION • MAINTENANCE

UMI

THE SURE SIGN OF A MODERN INDUSTRIAL PLANT



Air Circuit Breakers on All Main and Branch Feeders

He's not afraid. He knows it has plenty of "I C"

"I C" = Interrupting capacity

G-E air circuit breakers are available with interrupting ratings up to 80,000 amperes. You can depend upon getting the specified rating whether the breakers are mounted separately or as factory-assembled boards. If you have any question about how to determine the interrupting capacity needed, in order to know the size of circuit breaker to use, get in touch with the nearest G-E office.

THE severity of a short circuit depends largely on the capacity of the transformers that feed the circuits, and it can *not* be determined by the normal load on the circuit. As plant loads have grown, transformer capacities have been materially increased. Therefore, short circuits present an ever-increasing hazard. They seriously endanger personnel and property wherever the power supply has outgrown the interrupting capacity ("I C") of the protective devices.

Are you sure of your "I C"? With G-E air circuit breakers of ***known*** interrupting capacity, you *can* be sure.

GENERAL ELECTRIC

890-79

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Never before SUCH Easy INSTALLATION —NOTHING ELSE SO Modern

IF there were no service wires, it would just be a case of "hang 'em an' forget 'em."

But with knockouts all around and quick-acting, ever-tight Murray Solderless Connectors, installation is child's play. It's over and done with before you can say, "Jack Robinson."

Every feature of Murray Troughs is *modern*. There's a type for every purpose. The troughs are practically indestructible and in cases of need, access to them is quick and easy. Send the coupon for all the facts; for the reasons why it is good business for you to install Murrays. Metropolitan Device Corporation, Brooklyn, N. Y.

MURRAY DEVICES

- Safety Switches
- Meter Service Switches
- Entrance Switches
- Range Switches
- Meter Troughs
- Solderless Connectors
- Panelboxes
- Meter Boxes

Murray TROUGHS *for socket-type* METERS

Mail

Metropolitan Device Corporation
Brooklyn, N. Y.

Gentlemen: Please send me free of charge and without obligation, 20 page Murray Meter Trough catalog.

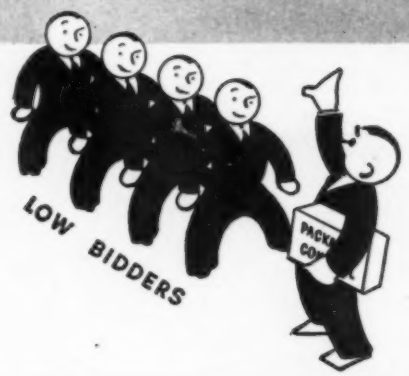
Name_____

Title_____

Company_____

Address_____

PROTECT YOUR PROFIT FROM SQUEEZED BIDS!



There is always somebody who will underbid you when you have nothing but price to offer.

The prosperous contractor knows that the way to lift himself out of price competition is to talk maintenance saving and money saving features. Note how these features pop out in the items of Westinghouse Packaged Control illustrated here.

Westinghouse Safety Switches

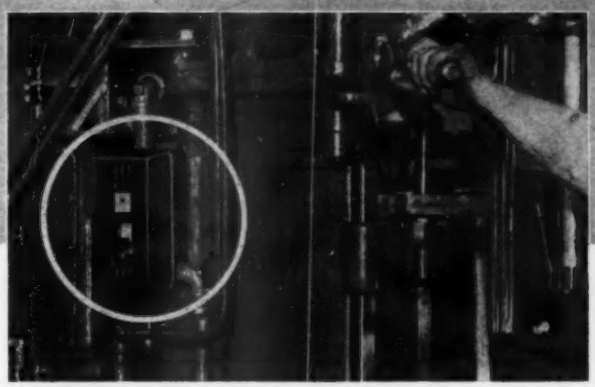
SAVE DRESSING DOWN JAWS AND BLADES!

The diamond pointed jaw and extended blade confine the arc to non-current carrying areas, leaving contact areas clean and free from beading. (Note the difference in the photos below.)

One-piece copper construction, having fewer connecting points reduces heating.

In 575 and 600 volt ratings, "De-ion" grids protect contact points — quench arcs immediately, prevent flashovers, prolong contact life.

Westinghouse



New "De-ion" Motor Watchman

CAN EASILY SAVE MANY TIMES ITS COST

Here is a new manual starter for motors up to 7½ hp. It has a bi-metal disc relay that gives accurate overload protection even after repeated operation. In case of overload, it immediately cuts the motor from the line preventing damage to windings. Can easily save many times its cost in motor repair bills.

NOTE THESE FEATURES:

- **Hand operated, self indicating toggle switch.**
- **Safety interlock prevents accidental contact with live parts.**
- **"De-ion" Arc Quenchers prevent flashovers, prolong contact life.**
- **Easy to wire and mount . . . knockout space in top, sides, bottom and back of case.**

LOOK FOR THIS TRADE-MARK

See your nearest Westinghouse Distributor

Ask your nearest Westinghouse distributor for sizes, types and prices . . . push buttons, switches, control, motors and electrical apparatus.

NOFUZE CIRCUIT BREAKER saves clay plant $18.00 A DAY

The man who recommended NOFUZE Circuit Breakers to a Western clay plant saved this plant $18.00 a day in losses due to fuse outages. Naturally he made a permanent customer for himself. For your customers bothered with losses due to fuse outages, recommend the Westinghouse Nofuze Circuit Breaker.

Westinghouse Combination Linestarter

This combination builds you up with your customers. Shows them how to get all necessary devices in the motor circuit in one compact and money saving installation. It provides:

- magnetic motor starter (push button operated).
- manual disconnect switch.
- motor overload protection.
- Nofuze circuit protection.

It is all available for the cost of ONE installation.

Packaged Control

UMI

How to Get ALL the LIGHT You Pay For and *PAY LESS* to Get It!

TURN LOX

is the Answer!

DIRTY REFLECTORS WASTE LIGHT!

As much as sixty per cent of the light you pay for can be wasted by dirty reflectors. Not only is this a waste of money but it is a waste that prevents your employes and your business from obtaining the maximum benefits of Better Lighting.

IMPORTANCE OF MAINTENANCE

Obviously, it is only when your Better Lighting is maintained at its original efficiency that you provide light that enables employes to see better and faster, that conserves vision, reduces eye fatigue and thus makes work easier, minimizes spoilage and reduces accidents.

WHY TURNLOX!

Ten years ago, Benjamin first introduced the TURNLOX SYSTEM for regularly maintaining industrial lighting reflectors at their original lighting efficiency with less time, greater safety and at the lowest possible cost.

Basically the TURNLOX SYSTEM is composed of two elements, a hood permanently connected into the wiring system and a reflector, which with the lamp makes up a separable unit that can be easily attached or detached.

A TURN AND IT IS LOCKED!

A simple quarter *turn* and the reflector engages in the hood and *locks* positively into position whether the light is on or off. Electrical and mechanical connections are made automatically.

A TURN AND IT IS UNLOCKED!

A simple quarter *turn* with a slight upward pressure releases the *lock*, permitting the reflector with lamp to be taken down as a complete unit for easier and faster washing on the floor. There is nothing to unlatch or unscrew—both hands are always free to guide and hold the reflector.

SAVES CLEANING TIME!

Thus with a few extra reflectors on hand it is even possible to change a bay at a time, replacing dirty reflectors with ones previously cleaned.

Moreover, with the patented Floor-Service reflector changing tool, reflectors may be removed and replaced safely from the floor—without ladder or interruption to production.

SEND FOR COMPLETE DATA AND DEMONSTRATION

For complete details on various types of Benjamin reflectors available with the TURNLOX SYSTEM, ask for booklet AD 3966 which we shall be glad to send you without cost or obligation. Address Benjamin Electric Mfg. Co., Des Plaines, Ill.

Since the First TURNLOX Installation 10 Years Ago

PROGRESSIVE PLANTS

Like These Have Specified Benjamin TURNLOX-EQUIPPED REFLECTORS

Allis Chalmers Mfg. Co.
American Can Company
American Tobacco Co.
Anaconda Wire and Cable Company
Armstrong Cork Company
Bethlehem Steel Company
Bridgeport Brass Co.
Brown Williamson Tobacco Company
Bucyrus-Erie Company
Buick Motor Company
J. I. Case Company
Caterpillar Tractor Co.
Chain Belt Company
Chrysler Corporation
Cluett Peabody & Co., Inc.
Coca-Cola Company
Colts Patent Fire Arms Mfg. Co.
Consolidated Aircraft Corporation
Deere & Company
Delco-Remy Corporation
Douglas Aircraft Co., Inc.
Dunlop Tire and Rubber Corporation
E. I. DuPont de Nemours & Company, Inc.
Eastman Kodak Company
Gaylord Container Corp.
Heald Machine Company
Kellogg Company
Kellogg Switchboard and Supply Company
Kraft-Phenix Cheese Corporation
Leeds and Northrup Co.
Lehigh Portland Cement Company
Lever Brothers, Ltd.
Libbey-Owens-Ford Glass Company
Liggett and Myers Tobacco Company
Liquid Carbonic Corporation
Lockheed Aircraft Corp.
Glenn L. Martin Company
Mechanic's Universal Joint Company
Nash Motors Company
National Cash Register Company
North American Aviation, Inc.
Olds Motor Works
The Owens Illinois Glass Company
Philadelphia Storage Battery Company
Philco Radio & Television Corporation
Procter and Gamble Co.
RCA-Victor Company, Ltd.
Ralston Purina Company
R. J. Reynolds Tobacco Co.
Servel Incorporated
Socony Vacuum Oil Company, Inc.
Standard Brands of California, Inc.
Stewart-Warner Corporation
Studebaker Corporation of America
Sylvania Industrial Corporation
Tennessee Eastman Corporation
United States Gypsum Co.
United States Rubber Co.
Universal Atlas Cement Company

BENJAMIN Turnlox

LIGHTING EQUIPMENT

Distributed Exclusively Through Electrical Wholesalers

electrical contracting

With which is consolidated The Electragist and Electrical Record
Established 1901

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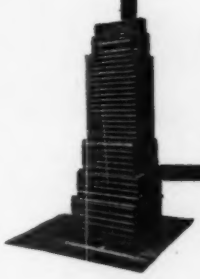

A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction—industrial, commercial, and residential.

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UMI

[*Make it happen to you!*]

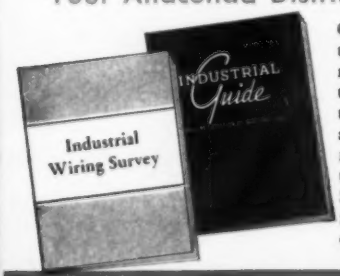
$2600 job goes to contractor who makes wiring survey—customer boosts annual profit $4800 as result

They turn out the lights when they leave—show them how to stop invisible electrical leaks that cost far more!

A lot of industrial plants are saving sizable amounts of money through "turn-off-the-light" programs. But, according to authorities, nine out of ten of those plants are losing what they save—and more—by putting up with inadequate electric circuits...circuits that overload and cause voltage drops and the invisible "evaporation" of power.

And here's where you come in. You have the equipment and experience to show any of those nine out of ten plants exactly where the bad circuits are and how to fix them. The only thing missing is the survey plan. And that's no problem. ANACONDA

Your Anaconda Distributor Will Help You



Contractors everywhere are finding that it pays to solicit industrial modernization contracts. Now is the time to plan your sales activities so as to reduce "repair work" and build up modernization. The material you need to develop industrial wiring is available without cost. See your local Anaconda distributor for complete sales plan and copies of the "Wiring Survey" booklet.

Industrial analyzer in use. Equipment like this can help you win modernization contracts. Photo courtesy Westinghouse Electric & Mfg. Co.

The customer in this case is a mill down in Georgia where over a period of years additions and changes to take care of increased production had caused electric circuits to become seriously overloaded. A local contractor made a complete wiring survey. Based on the survey, he won a contract for an entire new distribution system worth $2600. As a result, the customer increased production 3% which meant a profit boost of $4800 a year.

This all-purpose Anaconda cable has a remarkable record of continuous performance without a single reported failure... Clearly marked every foot for easy identification... Write for data on Duracode.

USE MODERN IMPROVED *Anaconda Wire & Cable*

ANACONDA WIRE & CABLE COMPANY, General Offices: 25 Broadway, New York City, Chicago Office: 20 North Wacker Drive
Subsidiary of Anaconda Copper Mining Company. Sales offices in principal cities

UMI

trical
tracting
JULY, 1939

Save the Job!

YOUR ANCESTORS AND MINE back in their caves were pretty smart. When two of them wanted the same gal, they settled the argument with clubs. The lad who lost, rolled down the mountain to the wolves. But the winner got the whole gal.

WE ELECTRICAL CONTRACTORS are more civilized. We fight for jobs. But we settle the argument these days by both clubbing the job into a pulp. And the winner takes the pulp.

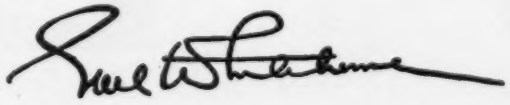
NOW MAYBE THIS IS BETTER. I'm not sure. For under our politer modern practice, everybody loses. The unsuccessful bidder still gets no job. The winner of the contract gets no profit. The customer either is left with an inadequate installation or gives up his tattered shirt on extras.

NOW THE BASIS OF IT ALL is ignorance and fear, as with most misdemeanors. Too many contractors do not know how to estimate. That's the ignorance. And those who do, are always worrying about what some incompetent will leave out, and they cut their figures to the bone. That's the fear. So the whole industry starves for lack of knowledge that is readily available.

A DAMN FOOL TRADITION is largely responsible for this mess. This tradition says that each man should guard his estimating methods as a holy secret. God knows why! And so skilled estimators, who know their costs, keep butchering bids and botching up the business, to compete with men who have not learned this part of their trade.

THE SIMPLE CURE FOR THIS CONDITION, I believe, will come some day through teaching all contractors how to estimate. We'll pool local estimating experience, so everybody will know how to figure. We'll teach the incompetents to cover their costs, and quit ruining us.

FOR AFTER ALL, YOU DON'T FEAR the competitor who knows how to figure. You fear the dumb boy who leaves things out and wrecks the job for everybody. So the skilled estimators should teach the art in every city. And why not? His better skill in designing and doing the work, will still keep the best man at the top. And when he wins a job, it'll be worth having.



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ARE YOU MISSING SOMETHING, MR. CONTRACTOR?

When you buy electrical materials are you getting just products—or products *plus* something extra?

If you buy from Graybar you get definite **EXTRA VALUES** with every dollar you spend. For example:

1. You get a solid Graybar guarantee backing up every sale and every product.

2. You get prompt "action service"... handy counters for quick pick-ups... fast truck delivery to rush you the items you need.

3. You can always call on the willing assistance of Graybar men experienced for years in meeting ElectricalContractors' needs.

4. You are invited to take full advantage of a nearby Graybar warehouse, carefully and amply stocked with the materials that Electrical Contractors need. Also, Graybar is glad to cooperate with Contractor customers in building up special stocks for specific needs.

5. You get products you can depend on from a company you can depend on... a company that has been serving the electrical industry for 70 years.

Don't miss these extras. Get them *all* by buying from Graybar.

IN 1869 GRAY & BARTON

70th ANNIVERSARY

Graybar ELECTRIC COMPANY

IN 1939 GRAYBAR

FUSES • WIRE AND CONDUIT • TAPE

WIRING DEVICES • LIGHTING • MOTORS

OFFICES IN 83 PRINCIPAL CITIES • EXECUTIVE OFFICES, GRAYBAR BUILDING, NEW YORK, N. Y.

Bidding to Federal Specifications

STANDARD FOR UNCLE SAM'S *construction all clear from the Bureau of Standards.*

The selection of government construction materials and supplies requires a background of Federal standards to avoid confusion and costly delays on the job

EVERYONE engaged in the business of construction or supply appreciates that specifications are a common meeting ground for producers, distributors, installers and purchasers. A proper specification is at once a statement of what the consumer needs and what the installer or supplier is to furnish.

Because of the vast supply needs of the Federal Government, the complexity of its construction activities, and the many bureaus whose technical staffs must specify, award and inspect electrical construction materials and equipment, the matter of preparing specifications has become quite an assignment. To understand how these specifications are prepared—where and how they apply—is of still greater importance to electrical contractors and suppliers who must comply with their intent.

Anyone undertaking a Government wiring contract, or bidding on supplies required by various federal agencies or purchasing authorities, is concerned with these fundamental questions:

1—What standard of quality or price range will comply with Federal specifications?

2—What procedure governs the approval of samples or methods of fabrication?

3—What products now being built according to commercial standards, will fully comply with Federal Standards?

4—What firms are willing to certify their products as based on Government standards and tests?

The Federal Government for fifteen years has been working toward the adoption of standard specifications. At the same time, they have been endeavoring to make these standards binding upon the many departments, bureaus, agencies and offices of the Government that purchase materials, equipment and supplies. The results achieved so far may be summarized as follows:

1. Government specifications are formulated by a Federal Specifications Executive Committee and are approved by the Director of Procurement. There were 1195 separate specifications on October 24, 1938.

2. If possible, standards are adopted that are in harmony with commercial practice. The desire is to avoid writing a new Federal specification that might involve unnecessary variations, or require special fabrication.

3. Commercial and industrial concerns, and various engineering and technical societies are invited to advise on Federal specifications before they are made effective.

4. The names of firms willing to certify to purchasers that their materials are guaranteed as based on Federal standards and tests, are listed by the National Bureau of Standards.

5. Electrical equipment standards are handled by the Federal Specifications Executive Committee. This committee has functioned for about fifteen years, and comprises technical representatives of Bureau of Standards, Interior, Navy, Post Office and Treasury departments, the Veteran's Administration, the District of Columbia, and other Government bodies.

Federal specifications have been developed for nearly all purchases included in the construction of government buildings. There are some exceptions, however, for example, the War and Navy departments, where special types of material are used.

Government buildings are usually inspected during construction by representatives of the Supervising Architect. These inspectors must interpret doubtful items that occur in Federal specifications. Since this involves contractors or suppliers in the field, any controversies arising from such interpretations can be appealed to the Washington office.

The most common field problems en-

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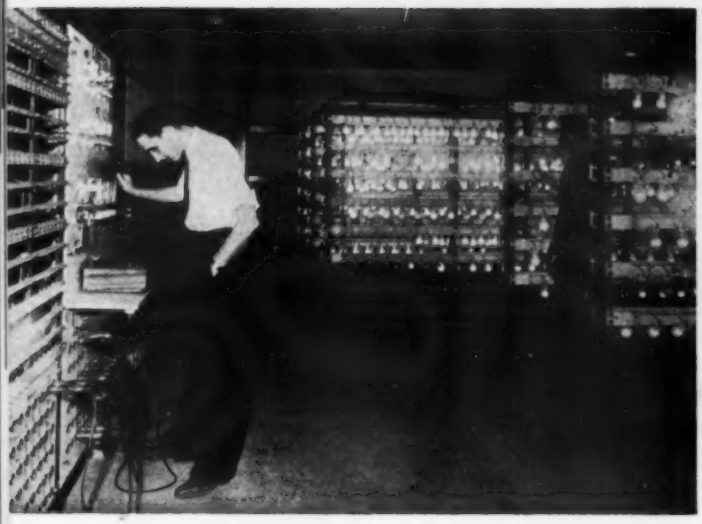
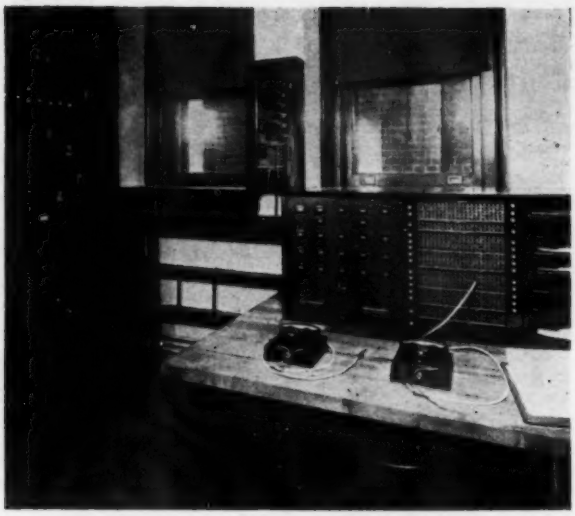


ELECTRICAL PRODUCTS *are tested to provide data. Here 6000 incandescent lamps are receiving their "life" tests.*



BATTERY TESTS *of dry cells are made with this apparatus of cells, switches, resistance coils and telephone jacks for instruments.*

countered by government inspectors and contractors have to do with locating outlets and equipment and the coordinating of electrical installations with work being installed by other building crafts. But equally important is the interpretation of the types, grades and test standards for all electrical materials that go into a government contract. If a contractor's estimate is based on the cost of sub-standard material, this is likely to result in disapproval, rejection, delay and perhaps financial loss on that contract. To eliminate this difficulty, the Bureau of Standards listing of "Willing-to-Certify" manufacturers was begun.

The degree to which Federal inspectors supervise building construction varies, according to the policies of the department. If the electrical specifications for construction projects contain references to numbered or coded Federal standards, it is up to the bidder to make sure his estimated costs are based on quotations obtained from "Willing-to-Certify" manufacturers.

Lists of such sources of supply are designated as Letter Circular LC 256A (in 12 parts). Individual lists may be secured upon specific request, also Letter Circular LC 277A which lists the sources of supply of commodities covered by commercial standards. A complete index of Federal specifications may be obtained for 15 cents a copy from the Superintendent of Documents, Government Printing Office at Washington.

A summary of Federal specifications covering the commonly used electrical commodities is presented here. Many reliable firms are on record as being willing to certify compliance therewith. From this data it is apparent that bidders should avail themselves of quotations from manufacturers who are experienced in the details of producing suitable materials.

Uncle Sam has tried through standardization to avoid delays and job losses. It remains for contractors to acquaint themselves with this established procedure. They must insist upon their suppliers observing it as well. If this is done, the headaches sometimes involved in meeting the Government's standards of quality will be greatly relieved.

FEDERAL SPECIFICATIONS COVER THESE AND OTHER PRODUCTS

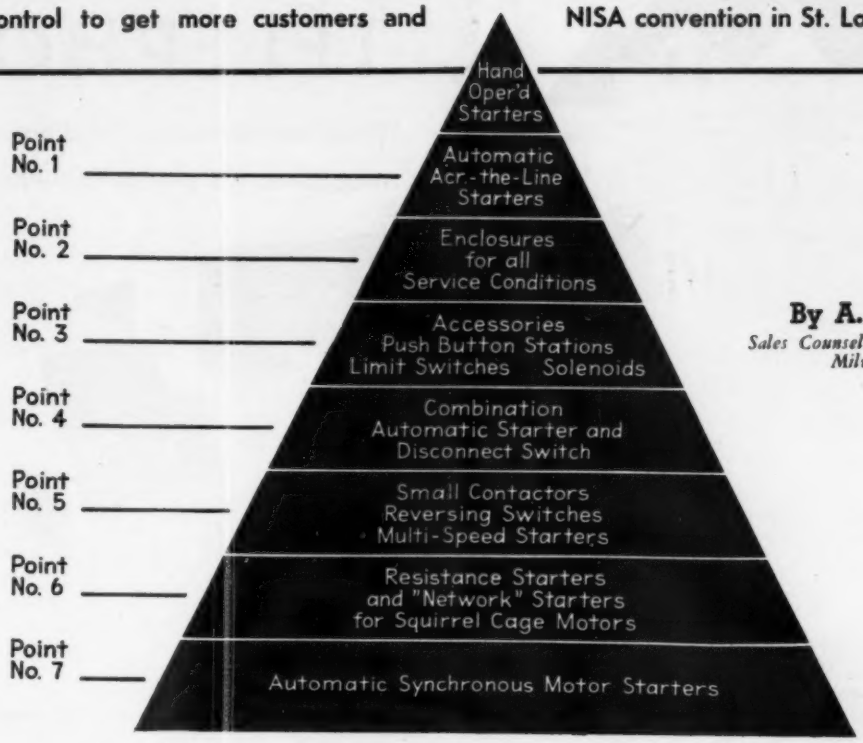
TITLE	SYMBOL	NOTE
Batteries, storage	W-B-131a	D
Boxes and Outlet-Fittings, floor	W-B-616	E
Cable and Cord (armored and lead covered-armored)	J-C-71	A, D
Cable and Wire; rubber-insulated, Code-grade	J-C-101a	A, D
Cable and Wire; rubber-insulated, superaging-grade	J-C-106	A, D
Cable and Wire rubber-ins.—superaging-grade—not for buildings	J-C-121	D
Clock-Systems; electric	W-C-471	A
Conduit; steel, rigid, enameled	WW-C-571	D
Conduit; steel, rigid, zinc-coated	WW-C-581a	A, D
Fire-Alarm-Systems; non-interfering type	W-F-391	
Fire-Alarm-Systems; shunt-type	W-F-396	
Fittings; cable and conduit	W-F-406	
Fuses; cartridge, nonrenewable	W-F-791	A
Fuses; cartridge, renewable	W-F-803	D
Fuses; cartridge, renewable (fusible links separately inclosed)	W-F-805	D
Fuses; plug, nonrenewable	W-F-831	D
Outlet-Bodies; iron (cast or malleable), with covers	W-O-806	
Outlet-Boxes; steel, with covers and accessories	W-O-821a	
Panelboards; circuit breaker type	W-P-131	D
Panelboards; fusible or switch and fusible type	W-P-146	
Raceways and Fittings; metallic underfloor	W-R-36	
Raceways and Fittings; non-metallic underfloor	W-R-41	
Receptacles; attachment-plugs, current taps, and connectors	W-R-151	A, D
Switches, knife, open-type	W-S-871	A, D
Switches; multiple-type and combination devices, with plates	W-S-893	A, D
Switches; single-unit, interchangeable, with plates	W-S-896	A, D
Tape; friction	HH-T-101	D
Tape; rubber, insulating	HH-T-111	D
Tubing; electrical metallic	WW-T-806a	D
Tubing; flexible, nonmetallic	HH-T-791	D
Wire; rubber-insulated, building-type, code-grade	J-C-101a	A, D

Explanation of Notes: "A"—Amended; "D"—Willing-to-Certify lists of manufacturers available; "E"—Specifications awaiting approval by Director of Procurement.
Most of the foregoing specifications may be obtained for 5c per copy from the Superintendent of Documents, Government Printing Office, Washington.

UMI

TO STEP UP CONTROL SALES

Seven suggestions—how to use motor control to get more customers and more profits as told to the recent NISA convention in St. Louis.


Hand Oper'd Starters
Point No. 1
Automatic Acr.-the-Line Starters
Point No. 2
Enclosures for all Service Conditions
Point No. 3
Accessories Push Button Stations Limit Switches Solenoids
Point No. 4
Combination Automatic Starter and Disconnect Switch
Point No. 5
Small Contactors Reversing Switches Multi-Speed Starters
Point No. 6
Resistance Starters and "Network" Starters for Squirrel Cage Motors
Point No. 7
Automatic Synchronous Motor Starters

Market Expansion Diagram for Control Sales

By A. H. Fensholt
Sales Counsel for Allen-Bradley Co., Milwaukee, Wisc.

THERE will always be a vast amount of machinery for which motors and suitable controls must be supplied by industrial service organizations. But those who supply this apparatus must be careful to avoid the easy habit of taking routine demand too much for granted. Conditions in the plant have as much influence upon the choice of control as the motor itself. For example, a power shear may be used indoors in one plant and outdoors in a scrap yard. A separator may be used in the non-explosive but humid atmosphere of a dairy plant or in the explosive but dry atmosphere of a varnish plant. A compressor may be installed in a dry loft or in a damp basement.

The average plant manager does very little thinking about control, because he knows very little about it. What he needs is the thoughtful advice of his local industrial service organization—a sound recommendation based upon a comprehensive knowledge of what's what in modern control. So we have

A. H. FENSHOLT

our first point to consider.

Point No. 1—Promote safety by selling magnetic starters.

The first thing anyone thinks of to control the average motor is a hand-operated starting switch. Is this good control engineering? And is this good business for the industrial service organization? The conventional hand-operated starting switch fails to provide one of the most important features now demanded in industry—safety to the machine operator.

No factory manager or owner is indifferent to safety today. An average manual starting switch may cost from $6.50 to $9.50, while the same size of magnetic starter with no-voltage protection and overload relays will cost from $16.00 to $18.00. The difference is a small, one-time insurance premium that protects the man, the motor and the machine for the life of the starter. So here is the first point in a program for using the normal sales opportunities in motor control to get more business—and bigger profits.

Point No. 2—Sell the proper enclosures.

There are hundreds of installations in which general purpose enclosures are now being used to the disadvantage of

(*Continued on page 43*)

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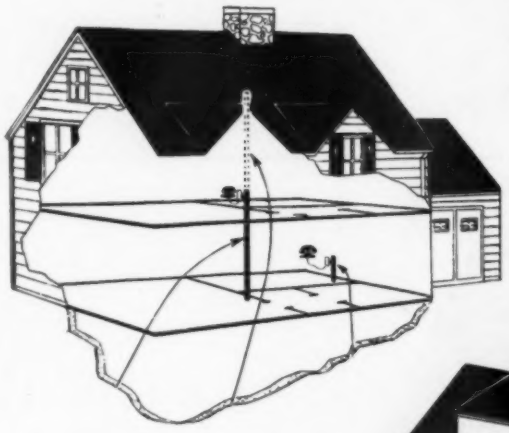
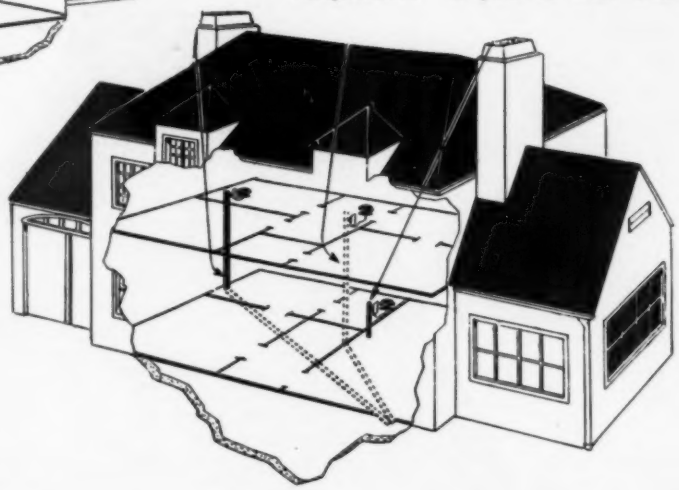
Sell TELEPHONE C

Telephone companies have brought about a wide

telephones. It proves that this extra con- veni



SMALL HOMES *need raceways to hide wires in finished basements, for serving the second floor and to reach telephones over unfinished basement areas.*



LARGER HOMES *can have complete freedom from exposed wires serving various telephones, when a properly planned raceway hookup is employed.*

OBSTRUCTIONS DEFEATED — *Walls blocked with insulation and fire stops require a simple raceway system to telephone outlets, to avoid botch-job extensions.*

ELECTRICAL men in larger communities are generally familiar with the telephone planning service rendered to architects and builders of department houses and commercial buildings by companies of the A.T. & T. system. But the expansion of this work to cover the small-home field is not so well known.

Right now, and in nearly all parts of the country, architects, home builders and owners are being contacted by telephone planning staffs. These men are out to make telephones easier to use in homes of all sizes. They tell a simple message, and are making substantial progress. The result is that residence wiring jobs for many small homes today include telephone outlets, connecting raceways, and sometimes overhead or underground raceways.

The success with which the "Architects and Builders Service" staffs of the various regional telephone companies are getting these facilities put into new homes indicates a new consciousness of the importance of convenience in the home and the avoidance of exposed wires, or possible drilling of holes in floors or walls. So whether he knows it or not, telephone salesmen are now working to help sell the idea of telephone raceways in new residences to the benefit of the electrical contractor.

As an example of the progress being made in this connection, here are some highlights—

1. *California*—About 65 per cent of all new 6 and 7-room homes in one large city have telephone raceways. Some 98 per cent of the seven-room homes and larger, costing $10,000 or more are so wired. Another large city reports 85 per cent of its low cost homes with raceways.

2. *Western Pennsylvania*—The idea is so well received here that 99 per cent of the new $10,000 homes have raceways, also 86 per cent of the $5/$10,000 class, and about 34 per cent of the homes running under $5,000.

3. *Rocky Mountain States*—Among the speculative houses built to sell for $5,000 or less, 44 per cent have telephone wiring. Similar homes built by

E OUTLETS too

ut a wide acceptance of raceways for residence con- venience can be sold to small houses.

the owner show 52 per cent with raceway facilities.

4. *New England*—Here 2511 installations were made in 39 per cent of all new homes—of recent construction.

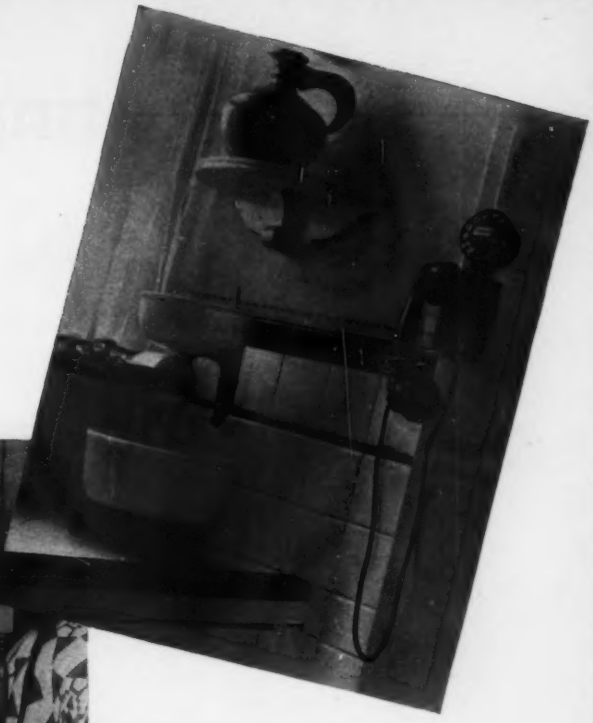
5. *New Jersey*—Among the many communities checked, an average of 40 to 70 per cent was reported.

What is being done in these areas is going forward in other sections as well. The telephone company in nearly every community now has an "Architects and Builders Service" department. It is set up to work out telephone suggestions for private owners, as well as architects and builders' and it will be profitable for contractors to become better acquainted with the field men who make up these telephone planning staffs. They will contact your architect and builder customers and assist in selling this additional work for you. It may mean the installation of one or more outlets employing varying amounts of conduit or electrical metallic tubing. It is all plus business.

The customer benefits are—

1. Adequate outlet provisions save steps and provide privacy for conversations.
2. Concealed raceways to several convenient telephone locations are simple to install during construction.
3. Built-in facilities help preserve the beauty of a new home. Exposed wires on baseboards and mouldings are avoided. No drilling of holes in walls or floors.
4. Insulation in walls and other obstructions prevent hiding the wires, if raceways are not built in during construction and phones are added.
5. Telephone service raceways improve outside appearance of the home, and also provide protection against wires being cut by burglars.
6. Raceways shield the wires from damage by rats, and from moisture or mechanical injury.

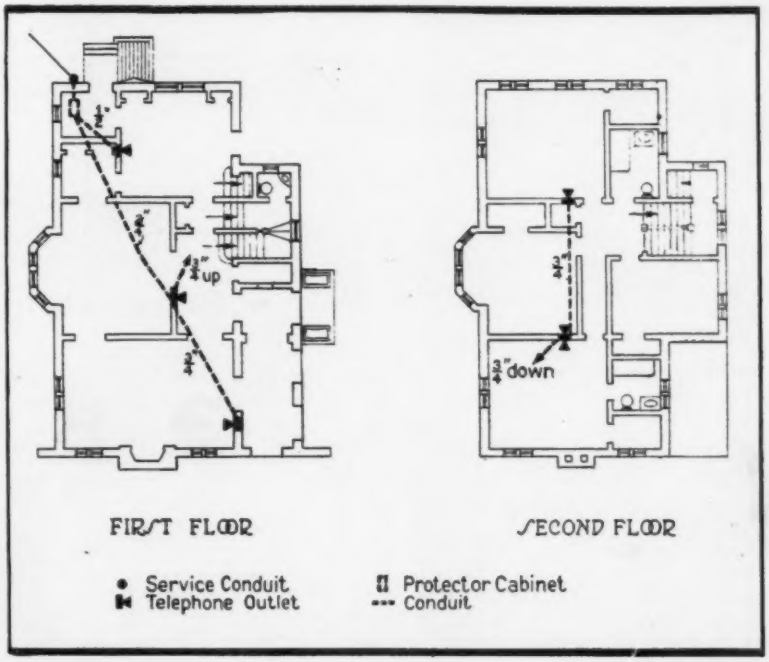
Modern builders are alert to new ideas that will help them sell new homes. The electrical contractor has the same opportunity to extend and popularize his work.



KITCHEN OUTLETS—*A step and time saver for ordering and making routine calls while watching the stove.*

NEAR BEDS—*Extra phones save stair-climbing, and are always ready for urgent calls. Raceways hide the wires.*

PLANNING THE RUNS *in larger homes, include telephone raceways to look like this on a floor layout.*



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Cove Lighting a NARROW STORE

Modernization job in Reading raises 10 foot candles to 50 with an interesting technique

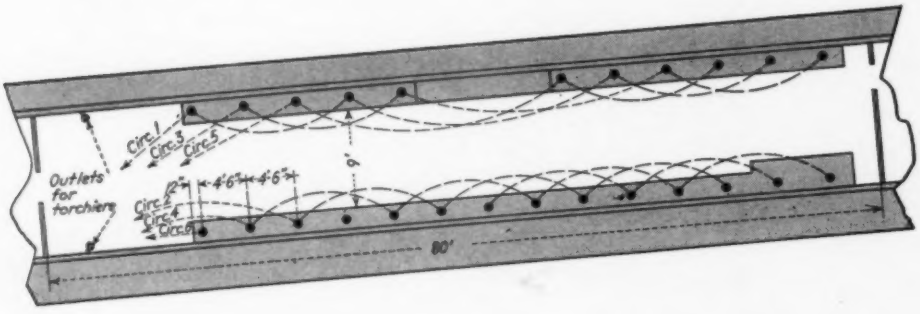
A JUMP from 10 foot candles to 50 was made at the Maurice Weiner store in Reading, Pennsylvania, when the lighting in this narrow store room was recently modernized. It was done with twenty-five indirect reflectors, 300 watt size, concealed atop wall cases. These units replaced eight 200-watt suspended commercial lighting units, making this one of Reading's brightest lighted stores. As a result, this small store is using about 8.8 watts per square foot of sales area.

The tops of the 7-ft. high cases were provided with a 10-inch valance board to screen reflectors, set 11 inches back of the valance board. These boards were cut out at intervals to form silhouetted letters, such as "Suits", "Topcoats", with the reflected light of the carved walls and ceilings.

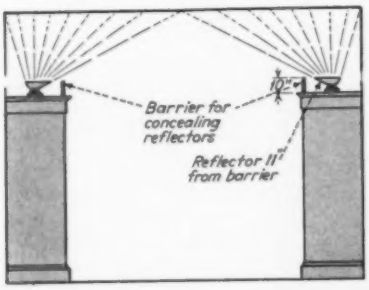
With a store width of 13 ft., 7 inches and a net width of 9 ft. between opposite rows of wall cases, a spacing of 4 ft. 6 in. to 5 ft. centers was established for the new reflectors. Initial lighting intensity for this arrangement was 60 foot candles.

The wiring was installed by the Keystone Engineering Company of Reading in accordance with lighting recommendations prepared by the Metropolitan Edison Company. To assure proper voltage at all outlets, No. 10 wire was used in the branch circuits. The layout included one 1500-watt circuit, while other circuits controlled four outlets, or 1200 watts.

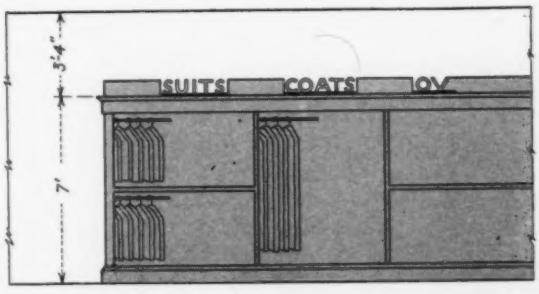
INCREASED FIVE-FOLD—*Indirect lighting for this long narrow store provides 50 f.c. compared with 10 before modernization.*



NARROW LAYOUT *for 80-ft. sales area. Here No. 10 circuits supply 8.8 watts load per square foot.*



SOURCE CONCEALED—*Vertical 10-in. valance boards on cases hide 300-watt reflectors placed 11 inches back.*



DUAL FUNCTIONS *are performed by this top-of-case valance, cut out at intervals for silhouetted letters.*

Moving A SHOE FACTORY

Some wiring responsibilities encountered in moving a busy plant

NEW LINEUP *of clicking machines for cutting out leather uppers. Individual ¾ h.p. motor drives operate from 550-volt 3 phase, supplied from a common feeder that was run lengthwise of each machine row.*

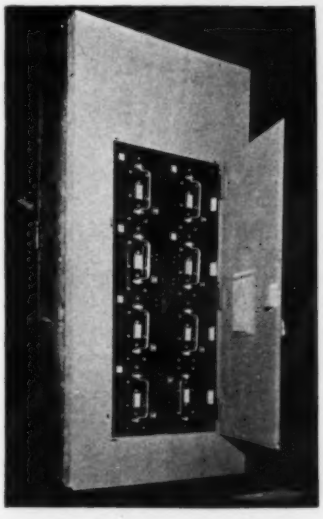
STITCHER AREAS *on various floors involved a maze of detail connections. Local adjustable lighting required assemblies of under-table conduit wiring. Power facilities varied from group to individual motors depending upon the bench layout.*

SHOE men were down in the dumps a year ago because of unfavorable tariffs. But recent changes in Central Europe indicate a more favorable condition for American shoe manufacturers. So the New England plants are perking up again. An example is the Gold Seal Shoe Corporation, which recently acquired a seven-story building in Boston to take care of enlarged production.

For the electrical man, moving a factory like this represents problems somewhat different from planning for a new industry unit. In this case, the work was done by the M. B. Foster Electric Company. It required careful supervision to coordinate the gradual steps in wiring with general moving operations. The shoe company formerly operated in nearby Lowell, and brought its equipment to the new Boston quarters by sections. So every mechanical force had to function on the dot.

Here are some important details that the electrical contract involved—

1. Completely exploring and testing all present wiring in the newly acquired building.
2. Making layouts of new loads and circuits to utilize the present wiring system to best advantage.
3. Locating available conduits in floors and columns to minimize running new exposed feeders.
4. Listing and checking customer machinery, motors and controls before moving them to the new location.
5. Inspection of all wired machinery for conformity with the requirements of local electrical inspectors.
6. Laying out the lighting system to provide general and supplementary illumination for each production area.
7. Preparing main distribution and feeder system in readiness for the moving schedule.
8. Setting up wiring crews to work with erection crews assigned to various floors.



MACHINE HOOKUPS *utilized existing control interconnections in many cases. But new line switches and auxiliary devices made each machine a detailed operation.*

LOAD CENTERS *on seven floors were in new dead-front panels fitted into the trims of existing flush power distribution cabinets.*

Since plants usually change or modernize some equipment while moving, the contractor has more to do than merely working out a layout for existing equipment. In this case, some departments were re-vamped and individual motor drives were applied. In other cases, new motor controls or refinements in auxiliary safety devices were added. These details added to the time problems in getting set up for production. But it was all done with minimum confusion, because the heavy wiring operations were planned ahead of the many small details.

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SCIENTIFIC BREWING *requires modern laboratory facilities. Here good illumination and electrical heating are essential.*

Wiring Ideas for Brewing a

CLEANLINESS and accurate control of processes are outstanding features of the modern brewer's art. And so it is with bottlers of beverages. Machines do much of the work. Human hands and eyes are aided by instruments and controls which function automatically. So the electrical system as well as equipment it serves, plays an important role.

In brewing, the handling of malt and other cereals involves cleaning, husking and grinding of grain. Conveyors move the materials to the final cooking process while pumps supply water of correct temperatures. These pumps transfer the wort through successive stages of fermentation, cooling, aging, filtering and final bottling.

Bottling, as done in modern plants, has become a highly mechanized operation. The steps are soaking, washing and brushing, before the sterilization of empty bottles. Automatic fillers and crowners, pasteurizers and labelers are all synchronized operations geared to conveyors beside lines of bottling machines.

So the wiring system is exposed to abuses of moisture, steam, condensation, heat and cold in many areas of breweries and other beverage plants. The control of refrigeration and pumping systems, of conveyor lines and local processing stations calls for special wiring hookups to prevent spillage and delays and to lend precision to modern methods.

Many Opportunities

Plants in this field vary in age and in their degree of electrification. Also, often years of exposure to abusive conditions have made the wiring ripe for replacement. So when new units of machinery are installed it presents an opportunity to survey other departments for needed improvements. This is because breweries and beverage bottlers are steadily improving products and working conditions. The chief benefits which electrical improvements provide are—

1. Improved production facilities.
2. Safety to employees, machinery.
3. Economy in power utilization.
4. Aid to sanitation measures.

All of these factors relate themselves to illumination, motorization and control, protective devices, and adequate, low-maintenance wiring.

This means that the processes and their movement in the flow of work require checking up for improvement through automatic or remote controls. The use of power for heavy-duty functions, as for refrigeration, may be stabilized to take advantage of lower energy rates. Accident hazards may be lessened by more adequate lighting provisions and by installing step-saving remote control stations. Maintenance costs can be lowered by remedying the effects of condensation in conduits and in lighting and control equipment. The poor performance of hard-to-start motors on skimpy feeders needs relief from excessive voltage drop. Outages that have delayed production can be run down and eliminated by adequate service and distribution equipment.

Such are the conditions to look for, and to point out. And the contractor who plans new wiring for the complete plant or who has such customers on his list should keep these points in mind. As a guide to planning, the following list of electrical applications offer reminders covering the more common plant equipment.

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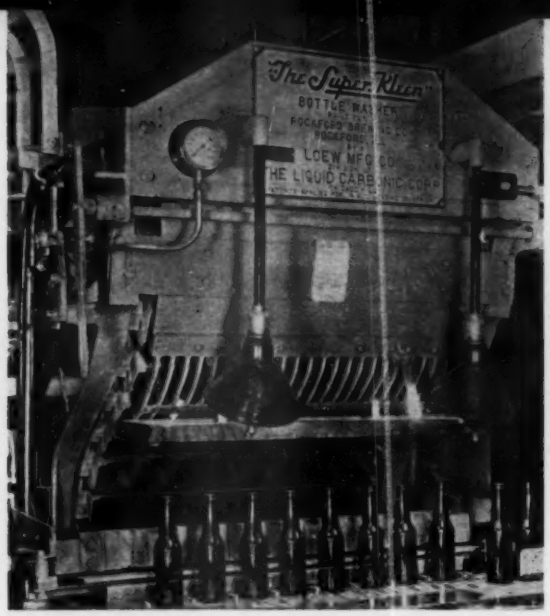
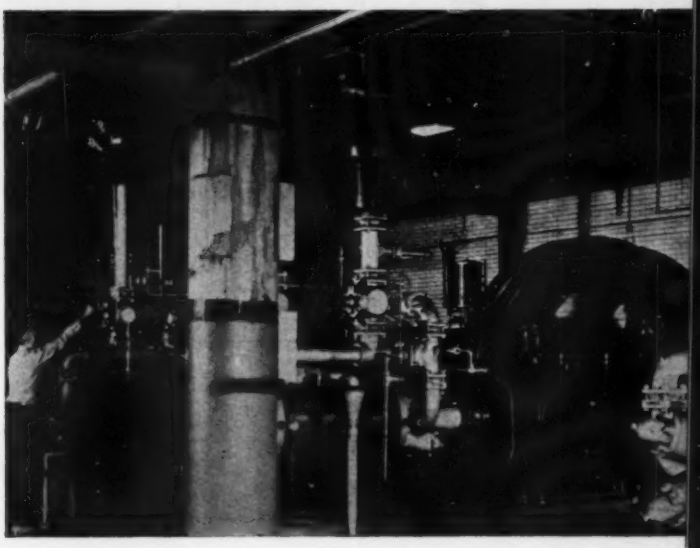


EXACTING INSPECTIONS *require good supplementary lighting for various operators, to insure steady flow of work under strict control.*

REFRIGERATION POWER *means adequate copper and a maze of control details. Efficiency and economical operations justify the best initial design.*

MODERN MACHINES *in the bottling room run into big money, so the electrical job should be planned to keep them running safely and continuously.*



g and Bottling

Seventh in a series of industry wiring reminder lists

CHECK LIST FOR BREWERIES AND BOTTLING

MOTOR DRIVEN EQUIPMENT

Agitators
Air Conditioning
Barrel Washers
Bottle and Capper Washing
Bottle Cleaners
Bottle Filling Machines
Capping and Wiring Machines
Carbonating Apparatus
CO_2 Salvage Compressors
Conveyors
Elevators
Fans, Ventilating
Hoists
Labelers
Machine Shop Equipment
Malt Machines
Mash Machines
Office Machines
Pasteurizers
Pitching Machines
Portable Tools
Pumps
Refrigerators
Trucks, Industrial
Water Purifiers

ELECTRICAL HEATING DEVICES

Beer Vat Dryers
Bottle Dryers
Branding Irons
Cookers
Cork Branding Machines
Glue and Rosin Heaters
Laboratory Stoves
Ovens
Radiators for Drying Casks
Ranges
Rice Cooker
Yeast Tube

SIGNALING EQUIPMENT

Annunciators
Bin and Hopper Signals
Burglar Alarms
Bells or Howlers
for start and stop signals
Code Calling Systems
Conveyor Signals
Fire Alarm Systems
Push Button-Buzzer Call System
Tank Level Alarms
Temperature Alarms
Telephones
Time Clocks and Stamps
Watchman Systems

LIGHTING RECOMMENDATIONS

Exit Lights
Flood Lights
Inspection Lights
Night Lights
Signs
Vapor Proof Fixtures
Vat and Cooker Lights

NOTE—General lighting intensities vary somewhat with the nature of working areas. In the brew house 5 foot candles is recommended, while for boiling, keg washing and filling at least 10 foot candles should be provided. For bottling an intensity of 15 foot candles is recommended, and in the office and laboratories at least 25 foot candles. Numerous local applications require special consideration, as for bottle inspections and at filling and capping machines. Good lighting is needed at landings and stairways.

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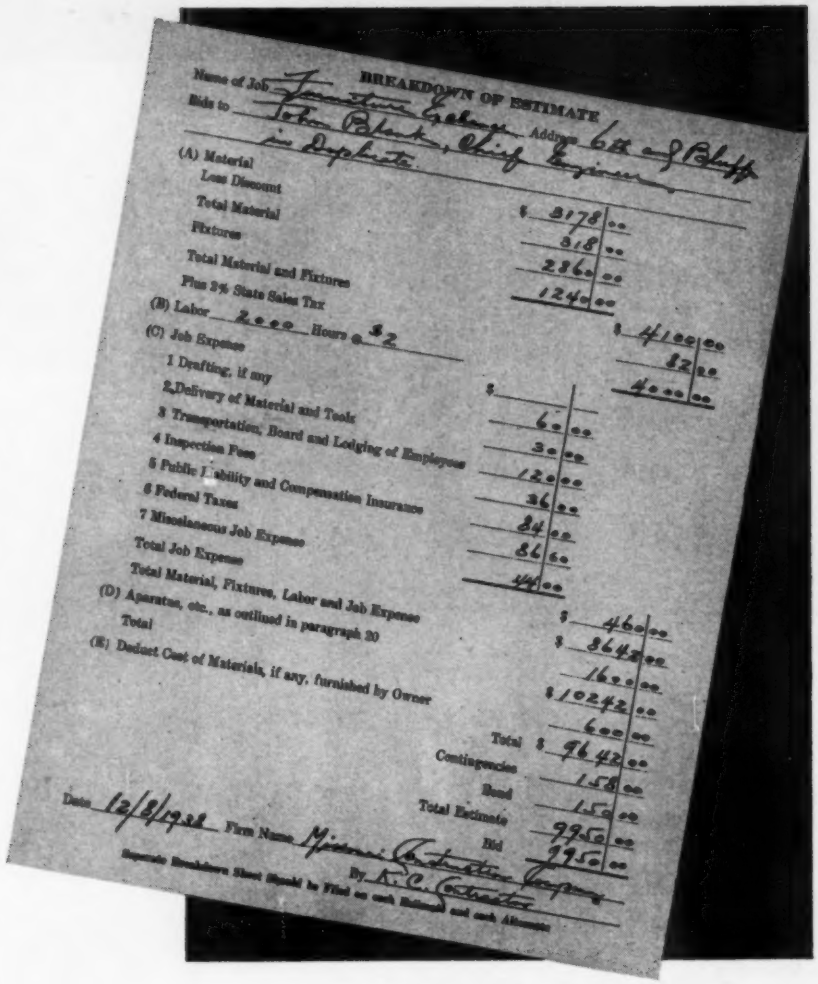
Facts PROVE the BID

Estimate Break-Downs Form a Strong Link in Kansas City's Fair Competitive Practices



BREAKDOWN OF ESTIMATE

Name of Job Jamestown College Address 6th & Polk

Bids to John Polanta, Chief Engineer

in Duplicate.

(A) Material		
Less Discount	$ 3178	00
Total Material	318	00
Fixtures	2360	00
Total Material and Fixtures	1240	00
Plus 2% State Sales Tax		$ 41000
(B) Labor 2000 Hours @ $2		820
(C) Job Expense		4000
1 Drafting, if any	$	
2 Delivery of Material and Tools	60	00
3 Transportation, Board and Lodging of Employees	30	00
4 Inspection Fees	120	00
5 Public Liability and Compensation Insurance	360	00
6 Federal Taxes	240	00
7 Miscellaneous Job Expense	860	00
Total Job Expense	440	00
Total Material, Fixtures, Labor and Job Expense		$ 460 00
(D) Apparatus, etc., as outlined in paragraph 20		$ 8642 00
Total		1600
(E) Deduct Cost of Materials, if any, furnished by Owner		$ 10242 00
		600
Total		$ 9642 00
Contingencies		158 00
Bond		150 00
Total Estimate		9950
Bid		9950

Date 12/8/1938 Firm Name Missouri Contracting Company

By A. C. Contractor

Separate Breakdown Sheet Should be Filed on each Estimate and each Alternate

BUGLESS BIDS—*Checking form used to find the bugs in Kansas City electrical bids.*

KANSAS CITY contractors have a Voluntary Code of Fair Competition which in two years or so has been of great value in increasing the number of participating firms. "The longer our Voluntary Agreement operates, the better it works" says W. T. McAuley, president of the Greater Kansas City NECA Chapter. An important phase of smoothing out rough spots in Kansas City's bidding practices is the method of breaking down estimates that is used.

Nothing can disrupt local competition more quickly than confusion, misunderstanding or charges and countercharges about what is included in a low bid. So when a group of disinterested men attempt to take apart the intricacies of some other member's proposal, all must be clear. They must find the facts as quickly as possible.

Here is the estimate breakdown form used by bidders who work under Kansas City's Voluntary Agreement. It is filled out in detail and filed with each estimate, also with each alternate proposal.

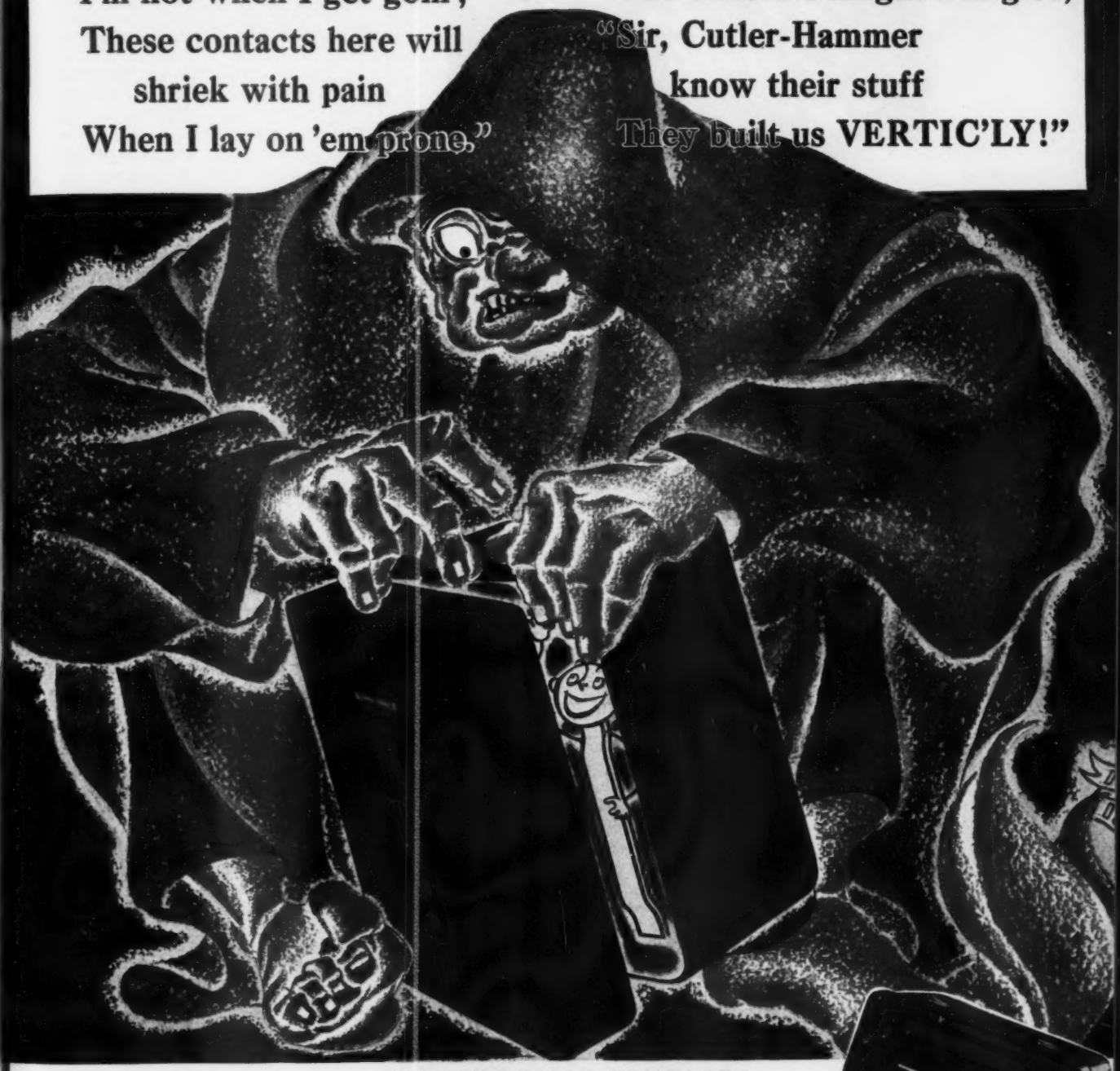
On it a hypothetical bid has been broken down and entered. Resale prices have been used throughout for all entries, in accordance with prevailing practice in Kansas City. This bid analysis indicates how such information tells its own story to those who must check up the facts. All the odds and ends of a job—insurance and taxes, and the scramble of special material or apparatus items—have been provided for.

Note the three separate places for entering material or apparatus items. Under "A", the general construction materials, less discount, are entered separately from the lighting fixtures. And because the inclusion of allowances for fixtures is so often stipulated in the architect's specifications, this form serves as a double-check. Furthermore, wide differences may arise in the grades of fixtures figured. This variable would be covered up in the entry for construction materials. Finally, heavier apparatus, such as transformers or motors, is entered under item "D", under a basis of handling that is otherwise stipulated in paragraph 20 of the local Voluntary Agreement. A place is provided under "E" for deducting the cost of materials, if any are furnished by the owner.

The Kansas City plan called on the participating firms to clean up their own back yards first. They did it by facing facts. Having done so they have gained the confidence of electrical wholesalers, the local Builders Association, lighting fixture manufacturers, their local utility and others. Out of it all has evolved an all-industry pledge of cooperation and a steering committee drawn from four major branches of the local electrical interests.

"Soon I'll have fun," snarled
demon DUST,
"I'm hot when I get goin',
These contacts here will
shriek with pain
When I lay on 'em prone."

But his proud boast soon
came to naught
The contacts laughed in glee,
"Sir, Cutler-Hammer
know their stuff
They built us VERTIC'LY!"



VERTICAL CONTACTS mean better Motor Control. Dust between contacts causes heating and burning. But dust *can't* settle on VERTICAL contacts. So Cutler-Hammer VERTICAL CONTACTS need not be buried. They are *out in the open* . . . always air-cooled, easily inspected, fully accessible—yet free from dust and dirt. Get the facts. Send for free book, "Dust, the Destroyer." CUTLER-HAMMER, Inc., *Pioneer Electrical Manufacturers,* 1306 St. Paul Ave., Milwaukee, Wisconsin.

ONLY VERTICAL CONTACTS CAN BE DUST-SAFE!

CUTLER-HAMMER
MOTOR CONTROL
C-H

UMI

Earl Whitehorne, Editor

New York Men Cleared

Electrical contractors everywhere will be relieved that the now notorious case against the group of prominent New York electrical contractors is settled. A technical plea of guilty has been matched with a nominal fine and a suspended sentence. That means that these men are morally cleared and entitled to congratulations. It can be as hearty as the sympathy which their many friends throughout the country have felt during the anxious period of their misfortune.

This case was purely local. But the fact that it was featured as a part of District Attorney Dewey's crusade against racketeers gave it an ugly flavor, made it sensational. So it became national news, particularly because it was linked in the public mind with reports of unsavory conditions in the New York building trades and the dragging NEMA boycott suit against IBEW Local No. 3. The prominence and prestige of the men involved made it a matter of grave concern within the electrical industry.

Counsel for these contractors made clear that the admitted technical infraction of the law, was committed in the effort to stabilize local practice in estimating jobs and dealing with labor. He predicted that such measures of cooperative competition would someday be legal. This formal statement was part of the final proceedings in the case.

Here we have another reflection of the well nigh intolerable difficulties involved in doing business today in our large cities. The pressure of labor demanding more pay for less work, the burden of mounting taxation and the increasing restrictions of the law on business operations, all impinge upon men beset with bad times and a necessity to carry on that the people they employ may continue to eat. It is not difficult to become involved in technical infractions of statutes.

And So We Burn 'Em Up

Once upon a time chimneys and cigarettes caused more fires than electricity. But now we have the high distinction as leader in destruction. Out of a total fire loss of $270,000,000, of which $90,000,000 was of unknown origin, we account for $29,400,000. Some $25,500,000 of this loss is charged to defective wiring and probably was.

And still we dawdle and pinch pennies over re-inspection! Inspection bureaus haven't enough money to hire inspectors and the public takes it on the neck. But that money would buy a lot of rewiring.

Part of the Job

A man who sells a motor or a welding outfit makes sure the customer knows how to use it. Somebody is always instructed. That's just common sense. But how about lighting? The contractor completes the installation, throws the switch, says "Ah!" and out he goes. He says nothing about the use of light.

But immediately lamps, reflectors and reflecting walls begin to accumulate dirt and illumination efficiency slides off. Also next week changes start taking place in the plant and in three months, there are departments in which the light is all wrong—just because nobody sees that lighting changes with the work.

Why abandon these customers? Why not leave a cleaning schedule or sell a cleaning service? And why not make a periodic check up and recommend revisions in the installation where needed? It should be part of the job.

Cuss 'Em but Bless 'Em

Cussing out inspectors has been quite a pastime in the electrical contracting industry. But look at the other extreme. How would you like to live and work in a no-inspection community. Think it over and appreciate that without someone to enforce minimums there is no bottom to electrical inadequacy.

Not long ago we visited a town where anything goes. We found the kind of wiring which makes you wonder how anything can operate—electrically. So our chips are down on more and better electrical inspections and any plan to get the help of inspectors in boosting wiring adequacy beyond the limits of Code rules.

Instrument Arithmetic

Have you ever shown industrial plant customers what it pays per ampere, when motors run 300 days of eight hours each, we'll say? Of course, voltage, power factor and the rate per kw, will vary the cost. But say it costs $7.50 per year per ampere. Working three shifts that would be $22.50. It is worth while developing some of these ready-to-shoot facts for use when you make tests with instruments.

The popularity of tong types of ammeters for quick tests is already determined. But to make them most useful in survey selling, have a little instrument arithmetic up your cuff and dramatize your findings. Reduce them to the language of cost.

The Psychology of Wiring Tests

Electrical inspectors are urging a revival of the old practice of testing wiring systems. Years ago every inspector tested the wiring system before he authorized the use of current. He detected open or short circuits, weak insulation, improper polarity, and checked loads on the circuit. But the practice was abandoned as standards for workmanship improved and the art advanced.

Today we have more and better instruments for making such tests, and they should be used. Vital benefits will come of it. It will dramatize the safety of electricity to the customer by emphasizing the importance of quality materials and workmanship.

The public will see that when a job is done it may look all right, but even electrical men can not be sure. They must test with instruments to find out. That means that it is dangerous to take chances on irresponsible workmen or old wiring that has been tampered with.

Room to Grow

While we talk about Code changes to permit the use of thin insulation and loading more than 40 per cent of the conduit space, it is easy to overlook one vital point. Nothing will be accomplished if contractors then use smaller conduit to save a few dollars on the job.

Benefit will come only if we continue installing present conduit sizes and provide room for future growth. If we do not, in a few years these pipes will all be choked again.

REA Loans For Wiring

Uncle Samuel continues to loan money to the rural cooperatives for financing the wiring of farm houses and barns. Every month a list of allotments is announced by the Rural Electrification Commission. It is going to many counties in many states. The work is being done by contractors and inspected under the Code.

Town contractors who still think they are not interested, better notice what is going on. Some still may not want this kind of work. But it offers a lot of good business to men who will meet farm conditions.

Let the Fairs Help

Not every contractor will get a chance to see for himself what fluorescent lighting has contributed to World's Fair lighting. But the story will be told in various ways from now on. The point is to take mental note of these new applications and use them for new and improved outdoor lighting effects for your prospects.

For instance, a hustling New Jersey contractor has already revamped the lighting for a large gasoline service station with fluorescent fixtures for all outdoor uses, including the drive-in area. Others will make capital of high-efficiency color effects. It all means broadened opportunity through having something new to offer for outdoor displays.

Back Talk

Free $10 Bills!

We doff our summer bonnet to J. Carl Baldridge of the Idaho Power Company in Boise. He recently sent to all the members of the Idaho Adequate Wiring Bureau this challenge—

"Suppose that, upon opening the pages of a magazine that had just reached you thru the mail, you found a $10.00 bill; would you use it? Sounds like a silly question doesn't it?

"The *Electrical Contracting* magazine is chock full of ideas that will be worth many times ten dollars to any contractor who will read them and act. If you are one of those that could do with a little more business, this magazine shows the way, and I am in no way connected with the subscription department either. It costs $2.00 per year for twelve copies. Lots of us spend more than that for smokes in one month."

We passed on Mr. Baldridge's idea of the $10 bill to our circulation department at once and have been opening our own copies of the paper eagerly ever since, but nothing has happened. But even so, we believe he is right. It's there just the same.

As To Code Changes

In May we published a frank statement of our attitude toward the Code changes recommended by the power companies and now under consideration by the NFPA Article Committees. The following comments give some interesting reaction—

To the Editor—"You said it, in 'Beyond the Crutch.' You can add any number of new wiring systems to those we already have and you still must sell them."

J. W. Collins, Secretary
Electrical Contractors' Association of Chicago, Inc.

To the Editor—"That editorial 'Beyond the Crutch' was a 'corker'. It doesn't mince words, it is honest and it paves the way for further statements. Nice work."

W. E. Sprackling, Vice President
Anaconda Wire & Cable Company

To the Editor—"I just read with interest your editorial entitled 'Beyond the Crutch'. You have summed up two policies which I considered very important. First, the industry's job is to sell more outlets and more capacity on all installations, new or old. Second, let engineering determine wiring methods, rather than having individual profits rule as to which methods of wiring are to be used. Reduction in unit cost of wiring, if obtained without sacrificing safety, by increasing volume, will increase rather than diminish the returns to every element in the industry."

A. H. Kehoe, Vice President
Consolidated Edison Company of New York, Inc.

To the Editor—"I agree with your editorial 'Beyond the Crutch' that we must from time to time endeavor to find more economical methods of installation. I believe the issue should be not alone 'Is it safe?', but, 'Is it adequate and of a permanent nature?'

Yes, the engineers should make the decisions, but the engineers should not represent either the utilities, manufacturers or contractors. I believe that your editorials are slowly but surely developing industry opinion which is helpful."

A. Lincoln Bush
Belmont Electric Co., New York

To the Editor—"Permit me to compliment you on your editorial in the May issue. An editorial of this character may do much to break down the resistance on the part of the electrical contractors to a greatly needed change in the Code."

J. R. Hartman, Manager
Electric Sales Department
The Cincinnati Gas & Electric Company

To the Editor—"Your editorial is another real contribution as it emphasizes the need for removing all barriers to a reasonable conception of adequate wiring. From time to time in the past, electric companies have had some concern when more efficient apparatus, particularly lamps, have been produced. I can distinctly recall two occasions in the past fifteen years when we were advised that the new types of lamps would result in substantial decreases in revenue. Now we know that increased efficiency and lower cost to the consumer is a stimulus to more business for the company and we welcome every new development.

"If the contractors could just be impressed with the enormous field open, and a great concerted effort could really be made for adequate rewiring at the lowest possible cost, I am sure they would be amazed at the rich profit there is in it for them. I am sure your messages are resulting in a better understanding and improvement in conditions."

G. M. Gadsby, President
Utah Power & Light Company

To the Editor—"I know nothing about 'the power company drive' for cheaper wiring, but if it is possible to employ cheaper wiring which is equally safe and possesses other qualities equally desirable as in more expensive wiring, it would seem to me that not only power companies, but all branches of the industry, should unite in a drive to have such improved wiring introduced.

"Contractors do not face any loss from improved and cheaper wiring, but can look forward to it with every degree of optimism. Today wiring standards are only a fraction of what they should be, and cheaper wiring should, with the proper sales backing, result in a tremendous increased volume to the benefit of the contractors and all other branches of the industry."

H. E. Young, Vice President
Northern States Power Company, Minneapolis

To the Editor—"You have hit the nail squarely on the head. Whatever is economically sound and safe will prevail in the long run, despite selfish opposition."

Clyde Chamblin
California Electric Construction Company, San Francisco

To the Editor—"I agree with you—these new materials, if approved, will not in themselves popularize adequate wiring. There is no public clamor for more wiring. But if our sales people, utilities, contractors and journeymen would suggest that with the new materials a more adequate job will result, and at a cost no greater, that would be helpful. We still have a selling job to do, and I am concerned that it be done in a way that will not incur opposition based on improper information or prejudice. The only real issue involved in any Code change is—'Is it safe?'"

G. E. Miller
The Cleveland Electric Illuminating Co.

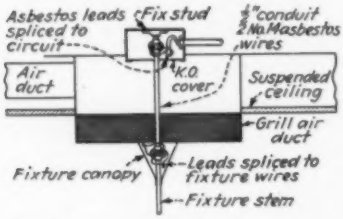
In our opinion the difference between power company and contractor thinking on this matter still revolves around one point. Utility men believe cheaper wiring will in itself bring more adequate installations. Contractors believe it will simply mean lower priced jobs. And we believe that nothing will increase the size of jobs but two fisted selling by the entire electrical industry that builds public interest and demand. Then naturally when people want more wiring, lower cost will aid the selling.

UMI

WIRING Methods

AIR CONDITIONING FIXTURE COMBINATIONS

Where air conditioning ceiling ports and lighting fixtures are combined in office and commercial buildings, the wiring of the fixture must permit ready removal for access to the air conditioning ducts. The accompanying diagram shows the method of fixture suspension and wiring used in a large factory



***CONDUIT STEM** from roughed in box through air conditioning port supports fixture and protects leads.*

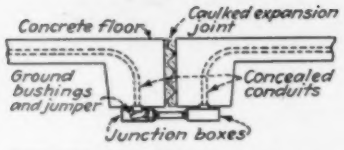
office building by Henry Newgard & Company, electrical contractors of Chicago.

The roughed in box is fitted with a standard fixture stud and a ⅜ inch to ½ inch hickey. A nipple of ½ inch conduit extends through the box cover k.o. to the bottom of the air conditioning port. Another hickey connects the conduit to the fixture stem. Joints are sealed with sealing wax.

Asbestos insulated leads are tapped to the circuit conductors and carried down through the ½ inch conduit and out at the lower hickey. They are then spliced to the fixture wires, the joints concealed by the fixture canopy.

CONDUITS COUPLED FOR EXPANSION

A new bakery plant at Philadelphia is constructed in sections for its 1000-ft. length, to allow for expansion in its upper steel structure. This required flexibility for expansion at all places



***BRIDGED UNDER**—Practical expansion joint for concealed runs of conduit in large areas.*

where concealed runs of conduit bridged such expansion joints.

The Utilities Engineering Company took care of this condition by stubbing all cross-over runs into exposed junction boxes located at either side of the joists. Short nipples were connected between junction boxes with one end locknutted securely and the other end left free to move through the box knockout. The free ends of the nipples are

***READY FOR WIRE**—Junction boxes and nipple under beams pick up 1-in. conduits to bridge the gap.*

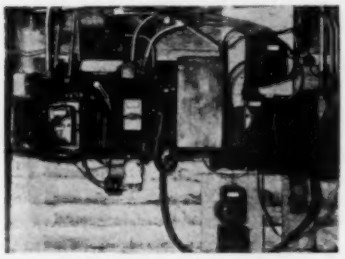
provided with a grounding bushing and a short jumper connected within the junction box to provide a suitable ground path for the sectionalized run of conduit.

This method was held to a minimum by laying out all branch circuits for connections to panelboards located within areas between expansion joints. Therefore it was only necessary to provide such junction boxes for runs to scattered outlets such as telephones, fire alarms, paging system, etc.

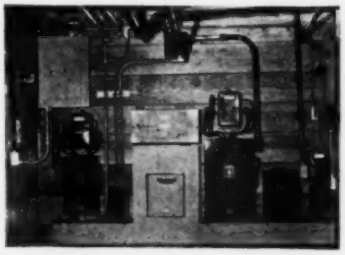
PICTURES SELL REMODELING

Construction superintendent, H. J. Martin, of the Briner Electric Company of St. Louis, has found that his hobby of photography can be used very effectively in his work. It built up a sales story for remodeling work and cleaning up "hay wire."

On jobs of this type, undertaken by the company, he sets up his camera



***TO HELP SELL** this contractor uses a camera from job to job and gathers evidence for coming customers to see.*

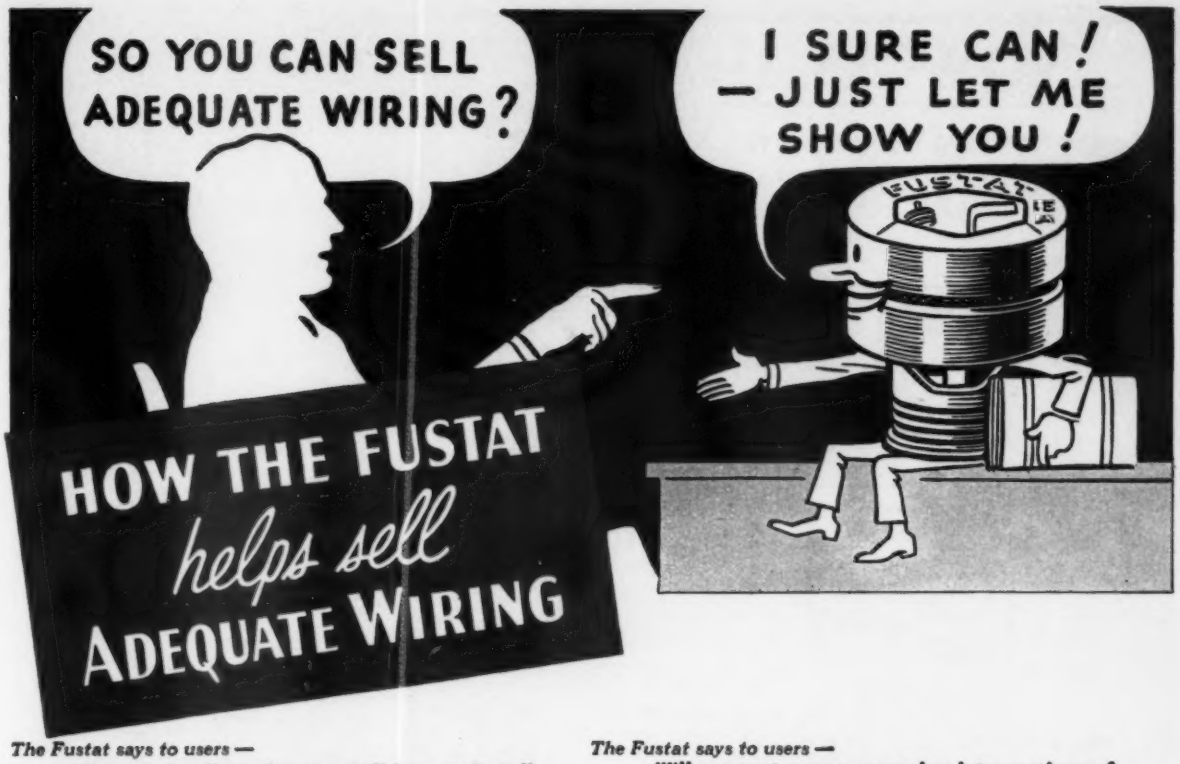


***PHOTOGRAPH TAKEN** "before and after" on this hay wire clean up job makes a powerful impression on prospective customers.*

and shoots a picture before the job is started. The spot from which the picture was taken is carefully marked and after the completion of the job another photo is taken from the same point. Putting the two photos together in "before and after" rotation in an album, tells a highly convincing story to the next prospect.

CLEANING UP CLUTTERED SERVICES

To get rid of unsightly and hazardous service spans attached to a low building involved a combination job for the Springfield (Mass.) Electric Company. A new pole structure was provided which untangled a collection of 2300 and 115/220 volt open spans. This new pole structure was arranged to support new runs of rigid conduit



HOW THE FUSTAT *helps sell* ADEQUATE WIRING

The Fustat says to users —

"No overloading, please, you'll have to install new circuits"

Users cannot permanently overload a circuit when it is protected by a Fustat of correct size. The Fustat cannot be replaced with a larger size and bridging it in any way is virtually impossible. If additional circuits are needed the user cannot side-step the issue at the sacrifice of safety.

The Fustat says to users —

"Now your toaster, percolator, etc., will always heat up quickly"

The user cannot load the circuit beyond the proper capacity of the copper. This prevents a voltage drop that is so frequently the cause of complaints about toasters, percolators and other appliances not operating efficiently.

The Fustat says to users —

"Now it's perfectly safe to add all the outlets you need"

Since the Fustat guards the circuit wiring against permanent overloading it becomes a perfectly safe practice to add as many convenient outlets to the circuit as are desired.

The Fustat says to users —

"In case of trouble I'll help keep all your circuits from being thrown out of service"

The branch circuit Fustat will almost invariably open on a short-circuit or overload, AHEAD of the main fuse or Fustat — because it cannot be replaced with an over-size fuse nor readily tampered.

When it does blow to protect, the shutdown is confined to just one circuit — and only the normal load of one circuit is off the line — instead of a user possibly having all of his lights and appliances out of service because a main fuse blew.

The Fustat says to users —

"I'll prevent many annoying interruptions of electrical service"

The long time-lag of the Fustat keeps it from opening when motors start on washing machines, refrigerators or other appliances, even though the circuit is loaded to approved capacity. Needless blows and irritating service interruptions are eliminated without sacrifice of safety.

The Fustat says to users —

"I'll help show you that the 'electrical way' is the best way"

The Fustat helps sell the electrical way of doing things — for it generally permits users to add new appliances without being annoyed by needless blows . . . it assures proper operation of appliances because low-voltage cannot be caused by overloading . . . it reduces chances of users being frightened by shorted cords burning up, for the quick action of the Fustat on dangerous cord shorts — prevents spraying of metal, starting of fires, burning of users . . . it helps teach user that the protective device is a desirable safeguard instead of a nuisance . . . *thus it assists the whole industry to build towards bigger business and better times.*

WHAT IS THE FUSTAT?

It is a fuse to which a thermal cutout is added.

It protects like a fuse against short-circuits — even high resistance shorts such as occur in flexible cords.

It protects against permanent overloads, even when as light as 25%.

Retails at 7½c

Yet it will not blow on motor starting currents of washing machines or other appliances.

It has a base that guards against anyone robbing the circuit of protection.

It fits Edison base fuseholders through the use of an inexpensive adapter.

It's just good business to sell, install and use Fustats

The FUSTAT

For Full information write to any of these firms

BUSSMANN MFG. CO., University at Jefferson, St. Louis, Mo.
JEFFERSON ELECTRIC COMPANY, Bellwood, Ill.
KIRKMAN ENGINEERING CORP., 121 Sixth Ave., New York City
NATIONAL ELECTRIC PRODUCTS CORP., Fulton Bldg., Pittsburgh, Pa.
UNION INSULATING CO., 27 Park Place, New York City

Retails at 7½c in 15 to 30 amp. sizes

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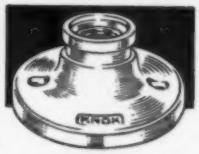
NOW AVAILABLE

No. 1170

PORCELAIN COVER
For 3¼" Box
They Sell on Sight

OVERSIZE RECEPTACLE
by
KNOX



No. 1680

PORCELAIN KEYLESS RECEPTACLE
For 3¼" Box
More Eye Appeal

½ inch Larger than Standard

No. 1793-C

PORCELAIN PULL CHAIN RECEPTACLE
For 3¼" Box
Over Five Hundred Satisfied Users

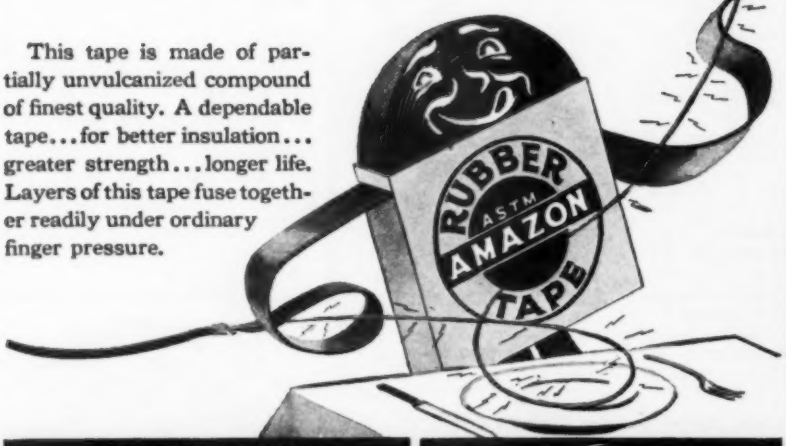
THEY COVER UP
1 Cracks and Holes
2 Rust and Dirty Spots
3 Broken Plaster etc., etc.

See Your Jobber Now or Write Us For Samples and Prices

KNOX PORCELAIN CORP.
Knoxville, Tenn.

"HOT JUICE" IS MY MEAT!"

This tape is made of partially unvulcanized compound of finest quality. A dependable tape... for better insulation... greater strength... longer life. Layers of this tape fuse together readily under ordinary finger pressure.



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RUBBER TAPE
DISTRIBUTED BY
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IN 1869 GRAY & BARTON
70th ANNIVERSARY
GraybaR
ELECTRIC COMPANY
IN 1939 GRAYBAR

OFFICES IN 83 PRINCIPAL CITIES. EXECUTIVE OFFICES: GRAYBAR BLDG., NEW YORK

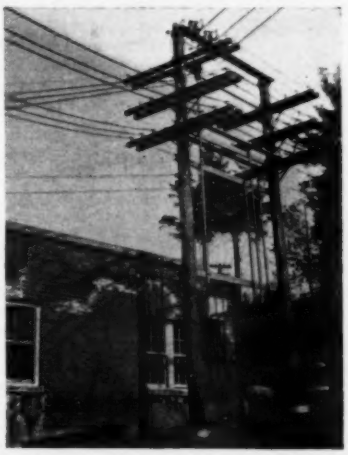
WIRING Methods

[FROM PAGE 22]

which enclosed conductors that were formerly bracketed to the building, and were within reach from the ground.

This work was done at the U. S. Veterans Hospital, Northampton, Mass. Here a low service building had a 2300-volt incoming feeder and five sets of low-voltage outgoing feeders. These were re-vamped without interrupting service. It required 160 man-hours for a 4-man crew to do the job. Principal operations consisted of setting two 40-

WITHIN REACH from ground, these wires formerly included a 2,300-volt span feeding this building's transformers which offered a serious hazard.



SERVICE CLEARANCES established for low structure by setting new pole structure alongside.

ft., 8-in. top poles, installing cross arms and steel braces and rearranging the old yard spans. One 3-in. and three 2-in. conduits were connected to the service building wiring and brought up the pole structure to replace the open work. The old pole was dismantled after this changeover was completed.

The NEW FLEX-O-LITE Fluorescent Lighting Unit IS NEEDED!

Because—Grading, Inspecting and other Industrial Jobs are made easier. Eye-strain and resulting fatigue are eliminated.

The New FLEX-O-LITE Fluorescent Unit for Industrial Lighting Purposes:

- Gives Steady Light with warm "daylight" color
- Eliminates Sharp Shadows and Glare
- Is Not Affected by Normal Temperature Changes
- Starts Immediately
- Delivers High Efficiency
- Has Life in Excess of 5000 Hours
- Consumes Less Power

The new Unit is available in two models. The HC-10 uses one tube, delivers 85 foot candles at 30 inches, and consumes but 150 watts. The HC-12 uses two tubes, delivers 150 foot candles at 30 inches, and consumes but 200 watts.

FLEX-O-LITE COMPANY
ST. CHARLES ILLINOIS

SEND THE COUPON TODAY

You will receive Complete Specifications, Details and Prices.

FLEX-O-LITE COMPANY, St. Charles, Illinois.

Please send me complete details, specifications and prices on the new FLEX-O-LITE Industrial Lighting UNITS.

Name .....

Company .....

Street .....

City ..... *State* .....

☐ Electrical Contractor ☐ Jobber EC-7

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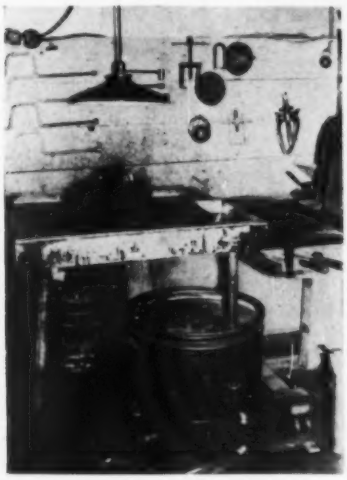
Motor Shops

CLEANING BENCH

Localizing the dirty work and saving on solvents are virtues of a specially constructed cleaning bench in the Electric Motor Shop in Springfield, Ill. The bench measures 30 inches square and is built up of wood with liquid-tight sheet metal covering to form a shallow sink pitched slightly toward the front.



***MOTOR CLEANING** on a bench equipped with convenient solvent filter and sludge drain.*

A drain at the front right corner empties into a filter drum permitting solvents to be used repeatedly with only evaporation loss. A sludge sump at the left corner is guarded by a built up ridge to prevent solvent from flowing off but grease and dirt can be easily scraped over the ridge to drain off into a sludge can.

NEW DYNAMOMETER

A hydraulic electro-dynamic absorption dynamometer has been developed by Ernest Bernard of the Hyre Electric Company, electric motor repair specialists of Chicago. This new machine, used for determining motor horsepower and torque at various speeds and load conditions, consists of an alternating current generator with a closed circuit armature cooled by a flow of water. As the armature is immersed in water during this operation an additional hydraulic load is placed on the shaft. The dynamometer load is varied by a field rheostat controlling the field excitation.

The principal advantages of this new design are the elimination of external resistors and the combination hydraulic-electro-dynamic load which permits adapting the machine design to fit any kind of normal load curve. The stator assembly is free to revolve in ball bearings and equipped with flexible water connections and lugs on either side for hooking up a scale and counter-weight.

GEAR SHIFT SPEED CONTROL

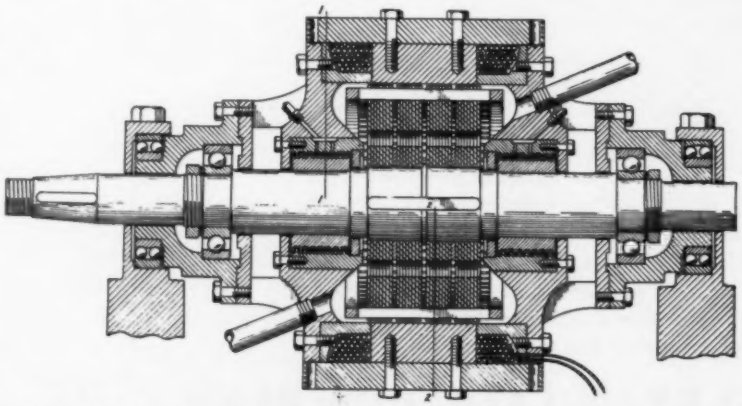
Speed control on a coil winding machine in the E. T. Sharpe Co. motor shop, Davenport, Iowa is provided by a compact motorcycle gear shift. A motor drives a counter shaft equipped with a step cone V belt pulley matched with a similar pulley on the "engine" side of the gear shift. The step cone pulleys provide an assortment of preset speeds, while the gear shift transmits two speeds ahead and a reverse to the winding head through a chain drive.

MOTORCYCLE GEAR *provides a compact variable speed drive to this coil winding equipment.*

CLEANING TANK FOR MOTOR PARTS

To improve the methods of cleaning motor parts, to reduce the time and obtain more thorough cleaning, the Scherer Electric Company of Indianapolis recently designed and built a pressure cleaning outfit.

An 8 gauge steel tank was made 73-in. by 30½-in. and 11½-in. deep, supported from the floor by six angle iron legs. The working level inside the tank is 27 inches above the floor. This provides a comfortable working height and avoids stooping. The tank's two sections have steel gratings supported one inch above



ABSORPTION DYNAMOMETER *combining a closed circuit rotor load with hydraulic load recently developed for motor testing.*

There's a profit in every foot

ORANGEBURG NOCRETE *the new Dual Economy* CONDUIT

For use underground without concrete encasement

NOCRETE conduit assures you of

• Savings in Installation Costs

It handles easy"; light in weight, in handy 5 or 8 foot lengths (in various sizes), this super-sturdy duct will surprise you by its adaptability.

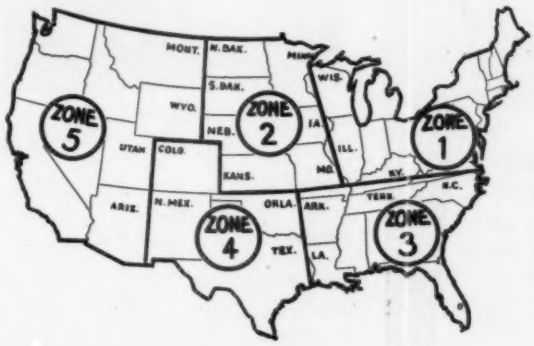
It assembles and installs easier, faster and at a lower cost than any conduit you have ever used.

It is readily cut and fitted with ordinary wood-working tools.

Approved by Underwriters' Laboratories, Inc. for installation underground (without concrete encasement)—Guide Card 60-014 File E 2557

On the very small Job, underground, as well as on the big Job, Orangeburg Nocrete will save you money.

Here's some of today's prices, delivered (freight) in your community in hundred foot lots,—(quantities less than 10,000 lbs.) Ask for the substantially lower prices on larger quantities, other sizes, (1½" to 4½ inclusive) and on other fittings, (all types).



Orangeburg NOCRETE Conduit
Prices per 100 feet, delivered.

Zones: (see map):	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
2" I. D.....	$14.60	$15.20	$16.90	$18.90	$20.80
3" I. D.....	19.20	19.90	22.70	25.70	28.40
4" I. D.....	27.20	28.00	31.90	35.30	38.90

Orangeburg NOCRETE "Stock" 90° and 45° Bends

2" I. D.....	$1.25 ea.	$1.30 ea.	$1.30 ea.	$1.40 ea.	$1.65 ea.
3" I. D.....	2.45 ea.	2.50 ea.	2.55 ea.	2.70 ea.	3.05 ea.
4" I. D.....	3.30 ea.	3.40 ea.	3.45 ea.	3.75 ea.	4.30 ea.

Write or phone our sales agents for detailed information and lower prices on larger quantities for your next requirement. It will pay you.

ORANGEBURG

Sales Agent—Distributors

GRAYBAR ELECTRIC CO., INC. **GENERAL ELECTRIC SUPPLY CORP.**

MADE AT ORANGEBURG, NEW YORK BY THE FIBRE CONDUIT COMPANY 292 MADISON AVENUE, NEW YORK CITY

ORANGEBURG *Standard* **for installation** *with* **concrete encasement**
NOCRETE for installation *without* **concrete encasement**

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CORNELL-DUBILIER

CAPACITORS FOR A.C. MOTOR APPLICATIONS

DESIGNED FOR YOUR REQUIREMENTS

MOTOR Starting Capacitors built as Cornell-Dubilier has built them for 29 years can help you make more money this year. There is always more money in dependable products. And to *famous* dependability, Cornell-Dubilier adds the extra profit-advantage of capacitors designed for your requirements — in a complete line.

For details on the entire C-D line of Electrolytic Motor Starting Capacitors write for Cat. No. 162 A.

Products of the world's largest manufacturer of capacitors.

CORNELL-DUBILIER CAPACITORS

CORNELL-DUBILIER ELECTRIC CORPORATION

1043 Hamilton Boulevard, South Plainfield, New Jersey

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FLOOR BOXES AND WIRING SPECIALTIES

No. 330 "Latrobe" Tom Thumb Utility Outlet

For use in wood installations, and other locations free from moisture or mechanical injury.

No. 285 Double Duplex Receptacle Nozzle

The most attractive, compact and easy-to-install fitting on the market. Shown in illustration with No. 200 Cover Plate.

The *Latrobe Line* is complete for all residential, commercial, and industrial requirements. In addition, the entire line is designed with the idea of reducing installation time . . . an important point to consider when selecting floor boxes and wiring specialties

No. 130 "Latrobe" Adjustable Water Tight Floor Box

No. 130 Box with No. 207 Bell Nozzle. Cut-away view illustrates how tapered unit receptacle fits tapered opening in adjustable ring. Design eliminates many small parts. Cover plate 3½"—overall height 3½".

FULLMAN MFG. CO.

LATROBE • PENNA.

Motor Shops

[FROM PAGE 26]

the tank floor, upon which motor parts are placed for cleaning.

Two storage tanks of 14 gauge steel, mounted below the tank, are 31-in. by 16-in., and 9-in. deep. The storage tank cover combines a built-in filter tank that slides over the tank like a drawer.

The cleaning fluid pump is driven by a ¼ h.p. motor, which provides 15 pounds nozzle pressure. Liquid flows through a ½-inch pipe and ½-inch gasoline hose to a ¼-inch brass nozzle 10 inches long. This long nozzle makes cleaning inside the bearing housings much easier than by former methods. The motor is controlled through a foot operated mercury tube switch.

Dirty motor parts are placed at the left-hand side of the tank. Cleaned parts are shoved to the right side or rinsing section of the cleaner. Here a duplicate pumping unit brings up clean liquid through a second nozzle, which thoroughly rinses the parts. A handy compressed air hose assists the worker in cleaning or drying the liquid from cleaned parts. The rinsing liquid is pumped into the cleaning tank after which fresh cleaning fluid is put into the rinsing tank.

PRESSURE CLEANING—*Parts are cleaned under nozzle pressure and the solvent is reclaimed.*

The cleaning fluid used is Stodsol, and costs about 13 cents a gallon. It drains through a series of ¾-inch holes into the strainer tank below. A 28-inch by 4-inch opening in the bottom of the filter tank is covered with a 60 mesh bronze screen. An 8-inch deep filter bed of wood planer shavings is put on the screen to catch the dirt and grit. The dirty shavings are replaced weekly.

Oil and grease is soluble in the Stodsol. This liquid can be drawn off and reclaimed by slowly filtering through Fullers Earth. Stodsol cleans as effectively as gasoline and is not dangerous.

Maintenance

WE ACKNOWLEDGE OUR DEBT SOME MORE

LAST July and January in this column, we extended our thanks to a number of engineers and companies who have given us their help in this series of Maintenance Guide Sheets. These were men of special knowledge who had drawn from their experience and that of their companies, to aid in the selection and simplification of these background studies of the important electrical equipment used by the modern maintenance man.

Again we wish to express our appreciation to another group of men who have contributed to the continuing articles. Therefore, we acknowledge our debt to—

E. S. Ruth of Edwards & Co.
E. G. Eidam of Stromberg-Carlson Telephone Mfg. Co.
L. F. Parachini of Weston Electrical Instrument Co.
C. Anderson and D. M. Boer of Westinghouse Elec. & Mfg. Co.
J. S. Hand of The Black & Decker Mfg. Co.
J. Lester Woodbridge of The Electric Storage Battery Co.
M. M. Rose and H. W. Sussman of Columbia Electric Mfg. Co.
Clarence E. Berger and George B. Hogeboom of Hanson-Van Winkle-Munning Co.
A. E. Bailey, Jr., of General Electric Co.

This series of articles began in January with a frank review of the electrical maintenance man's job.

Then came—

1. Alternating Current Motors
2. Direct Current Motors
3. A.C. Motor Maintenance
4. D.C. Motor Maintenance
5. A.C. Motor Starters and Controllers
6. D.C. Motor Starters and Controllers
7. Maintenance of Control Equipment
8. Special Control Problems
9. Electric Distribution
10. Lighting
11. Electric Heat
12. Electric Welding
13. Interplant Communication
14. Instruments
15. Power Tools and Appliances
16. Batteries and Rectifiers
17. Electroplating
18. Electronic Devices (In this issue)

Coming articles will discuss—

19. Transformers and Circuit Breakers
20. Equipment for Hazardous Locations
21. Wiring Devices and Cables
22. Drives
23. Elevators, Conveyors, Cranes and Trucks
24. Ventilating and Air Conditioning Equipment
25. Management of Maintenance

Electronic Devices

Applications and Maintenance

TEN years ago little was known about industrial electronic devices. Today many thousands of these devices have found their proper place in industry by proving that, in many applications, they can

1. Improve the quality of the product.
2. Reduce cost.
3. Remove objectionable features of present-day methods.
4. Provide the means of solving a vexing problem which has no other apparent solution.

The electrical maintenance man is therefore concerned with kinds of electronic devices, their functions, applications, and maintenance. This refers to electronic tubes and devices used for measurement, process or quantity control, alarm and safeguard, but of course does not include radio, television and communication.

The essential part of an electronic device is the electronic tube, or, as most commonly termed, electron tube. By definition—"electronic tube" is a generic term, applied to various designs of tubes (or tanks) consisting of two or more elements in a container, usually of glass, and having a high vacuum or filled with gas at reduced pressure.

The two general divisions of electron tubes are—

Thermionic which gets an impulse from electric voltage produced electrically, mechanically or chemically.

Light-sensitive which gets an impulse from a beam of light.

Both of these divisions have vacuum and gaseous or vapor types. The types according to their function in a circuit are known as amplifiers, rectifiers and oscillators, and according to their structure or number of elements in the bulb, as diodes, triodes, tetrodes, and pentodes. The terminology of the various electronic tubes is given in an accompanying table.

In the *vacuum type tubes* diodes are used for rectification; triodes are used for amplification, oscillation and frequency conversion; tetrodes, for the same purpose as triodes but they have a higher amplification factor; pentodes, for the same use as triodes but they

***TOOTHPASTE FILLER**—Photoelectric relays control position of toothpaste tubes in expander, at Bristol-Meyers Co., Hillside, N. J. (General Electric Co. photo)*

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***ELECTRONIC DYNAMIC BALANCER**, accurately indicates 0.001 ounce-inch unbalance, and by a stroboscope shows the tester exactly where to add or substract weight.* (*Westinghouse photo*)

are a more sensitive amplifier than triodes or tetrodes.

In the *gas-filled type tubes*, diodes, usually called phanotrons, are used for power rectification; triodes, called thyratrons, are for controlled rectification; tetrodes, for same use as triodes but they have a shield-grid.

In the *mercury-pool type of tubes* the ignitron is used for controlled rectification of power. In the same classification is the tank rectifier which is used for the same purpose.

In the *photosensitive type of tubes*, the vacuum phototube is operated by a beam of light and requires an external voltage supply. The gas phototube is similar to the vacuum phototube but is gas-filled and is more sensitive.

Photoelectric cells, such as the Weston exposure meter cells and Westinghouse Photox cells, are not electron tubes but are usually classed with them. They are self-generating, that is, they convert light energy into electrical energy, and do not require an external voltage supply.

Applications

Electronic devices have several uses; the principal ones are—

1. *Where a large amount of power is to be controlled by a comparatively weak impulse.* The main function of the tubes in this case is amplification. The tubes may perform a continuous amplification of the control pulse, or the control may be applied suddenly, as in the case of relay tubes of the grid-glow and thyratron variety. The weak control impulse may be of almost any form. If electrical in nature, it is applied directly to the amplifier or relay control tube. If it is in the form of light, a light-sensitive device (phototube or photoelectric cell) is connected in the input of the amplifier or control tube.

2. *Where an electrical quantity or another quantity is to be measured, such as temperature or pressure which can be converted into a corresponding electrical quantity.* The equipment is useful especially when the measured quantity is small, and when the amplifying property of electron tubes can be put to good use.

3. *For generating alternating current* of very high frequency for specialized uses, such as induction furnaces.

An accompanying table lists applications of various electronic devices. X-ray machines particularly of the portable type are increasing in use in industry. These machines enable massive steel parts to be diagnosed for possible defects.

Selection

In the selection of devices and tubes for applications, as well as for spares or renewals, the maintenance man should consider the following—

(Below)—Tube Terminology has not as yet been approved but is being considered by the American Standards Assn. Chart courtesy Electronics.

Industrial Tube Terminology

Names and definitions of tube types employed in industrial electronics, arranged according to type of space employed, cathode, and control structure, compiled by the General Electric Company as guide to terms in industrial field

Generic Term	Output Energy	Character of Space	Control Means	Type Cathode	Names	Definition
Electronic Tubes or tanks	Electrical	High Vacuum	None	Thermionic	Kenotron	A kenotron is a high-vacuum thermionic tube in which no means is provided for controlling the unidirectional current flow.
				Photoelectric	Phototube	A phototube is a vacuum tube in which electron emission is produced directly by radiation falling upon an electrode. A high-vacuum phototube is one which is evacuated to such a degree that its electrical characteristics are essentially unaffected by gaseous ionization.
			Electrostatic	Thermionic	Pliotron	A pliotron is a high-vacuum thermionic tube in which one or more electrodes are employed to control the unidirectional current flow.
			Electro-magnetic	Thermionic	Magnetron	A magnetron is a high-vacuum thermionic tube in which a magnetic field is employed to control the unidirectional current flow.
		Gas Filled	None	Thermionic	Phanotron	A phanotron is a hot-cathode, gas-discharge tube in which no means is provided for controlling the unidirectional current flow.
				Cold	Glow Tube	A glow tube is a cold-cathode, gas-discharge tube in which no means is provided for controlling the unidirectional current flow.
				Pool	Pool Tube or Tank	A pool tube (or tank) is a gas-discharge tube (or tank) with a pool-type cathode (liquid or solid) in which no means is provided for controlling the unidirectional current flow.
				Photoelectric	Phototube	See phototube definition under "High-Vacuum Tubes". A gas phototube is one into which a quantity of gas has been introduced, usually for the purpose of increasing its sensitivity.
				Thermionic	Thyratron	A thyratron is a hot-cathode, gas-discharge tube in which one or more electrodes are employed to control electrostatically the starting of the unidirectional current flow.
			Electrostatic Electrode	Cold	Grid-Glow Tube	A grid-glow tube is a cold-cathode, gas-discharge tube in which one or more electrodes are employed to control electrostatically the starting of the unidirectional current flow.
				Pool	Grid-Pool Tube or tank	A grid-pool tube (or tank) is a gas-discharge tube (or tank) with a pool-type cathode (liquid or solid) in which one or more electrodes are provided for controlling electrostatically the starting of the unidirectional current flow.
	Light Ultra Violet X Ray Cathode Ray		Ignition Electrode Electro-magnetic	Pool	Ignitron	An ignitron is a gas-discharge tube (or tank) with a pool-type cathode (liquid or solid) in which an ignition electrode is employed to control the starting of the unidirectional current flow in each operative cycle.

MAINTENANCE GUIDE SHEET
ELECTRONIC DEVICES

APPLICATIONS OF TYPICAL DEVICES

APPLICATION	NOTE	NAME OF DEVICE	ELECTRONIC PRINCIPLE	PRINCIPAL FIELDS OF USE
Air supply	2	Electronic precipitator	Rectification at high voltage to attract charged dust particles	Air conditioning in public places. Control of atmosphere in general industrial processing
Batching and packaging by bulk	2	Phototube batching control.	Control of phototube relay as batched material intercepts light beam	General
Burglar alarm	3	Infra-red phototube relay Capacity operated relay	Interception of invisible beam (infra-red) or presence of body capacity actuates relay controlling alarm	Factories, stores, homes exhibitions, general protection purposes
Conveyor control	2	Phototube conveyor control.	Objects on conveyor actuate phototube relay according to size, color and position	General plant practice
Color	1	Colorimeter Color comparator Color analyzer	Generation of photoelectric current in phototube or photocell; amplification	Paint, pigment and printing ink industries. Textile and paper industries. Biology
Counting	2	Phototube counter Capacity-operated counter	Actuation of relays by counted object (capacity relay used with metal objects only)	General factory applications, packaging and shipping
Door opening	3	Phototube door-opener Capacity door-opener	Interception of light or body capacity actuates pneumatic door control	Factories, restaurants, railroad stations, traffic control in crowded public places
Grading by color	2	Phototube color separator	Combination of one or more phototubes and filters actuating sorting relays	General. Egg, fruit, and vegetable packing
Illumination	2	Illumination control	One or more phototube relays control lamps as illumination changes	Factories, offices, schools. photographic processing
Light intensity	1	Photometer Illumination meter	Generation of photoelectric current in phototube or photocell; amplification	Photography. Lamp development. Illumination engineering
Motion limits	2	Phototube or capacity operated limit relay	Phototube or capacity operated relay actuated by object exceeding normal limit of motion	Automatic machine tools
Number	1	Electronic counters	Actuation of light-operated or capacity operated relay by counted object	General factory practice, conveyors, and packing. Traffic survey. Cosmic ray studies
Punch-press	3	Phototube punch-press control	Worker intercepts "curtain of light," actuates relay which prevents closing of press	General heavy machinery. General protection against industrial hazard
Regulation (electric)	2	Electronic voltage or current regulators	Vacuum or gas-filled tubes used to regulate resistance of supply circuit in terms of load. Control of generator field excitation	General electrical practice
Resistance (electric)	1	Wheatstone bridge (electronic)	Use of electron tube in one or two arms of bridge for high resistance measurement	General electrical laboratory practice. High resistance measurements
Smoke	2	Phototube smoke control	Phototube relay actuated by presence of smoke between it and light source	Combustion engineering
Temperature	1	Optical pyrometer	Measurement of color temperature by photoelectric means	Steel and alloy research and production. General laboratory practice. Lamp development
Temperature	2	Thermocouple with meter-and-phototube relay	Low impedance thermocouple connected to control relay by meter pointer actuating phototube relay	Metal manufacture. Chemical processing. Ceramics. Plastics
Time	1	Electronic timer	Measurement of charge accumulation on capacitor, by v-t voltmeter	Traffic controls and survey. General mechanical engineering and plant practice
Welding (resistance type)	2	Electronic welding timer	Ignition or thyratron tubes control duration of current through weld	Automobile, refrigerator, and general metal fabrication

NOTE: (1) — Devices for electrical, mechanical and optical measurements. (2) — Devices for process control. (3) — Devices for safeguards and alarms.

SOME POINTS FOR TROUBLE CORRECTION

DEVICE	TROUBLE	CAUSE	REMEDY
Capacity operated relays	Insufficient sensitivity	Mistuned oscillator circuit	Adjust tuning condenser
	Erratic operation	Too critical an adjustment of circuit	Rearrange location of pickup element to give positive response
Counting and sorting		(If phototube type, refer to photoelectric relays)	
	Counts do not register accurately	Insufficient current in counting relay	Replace relay tube
Photoelectric relays	Relay does not react when light beam is operated	Dirt on entrance lens of phototube housing	Clean lens
		Failure of phototube	Replace tube. Check ambient temperature
		Failure of amplifier or relay tube	Replace tube. Check line voltage
		Improper setting of relay tension	Adjust tension
		Dirty lens. Faulty focus	Clean lens. Correct focus
		Interference of light beam	Eliminate dust, steam, smoke, and mask out other light
Welding controls	Welds do not adhere strongly	Current too small or duration too short	Adjust timing cycle
	Welds burned	Current too great or duration too long	Adjust timing cycle
	Welds misfire (in continuous welding process)	Improper action of thyratron tube controlling timing cycle	Replace tube and test circuit voltage supplied to tube

CHECK-UP OF MAINTENANCE PRACTICE . . . SECTION 18.

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***AUTOMATIC GAUGE** for measuring, grading and sorting small permanent mold castings. In the foreground is a scleroscope, upon which photoelectric equipment is attached, so that automatic indication of the bounce of the scleroscope hammer allows passing or rejection of the finished piece. (Electronic Control Corp. photo)*

1. Reliability of the manufacturer and the service agreement offered.
2. Simplicity of the device.
3. Whether or not the device employs up-to-date tubes.
4. Operation limits, such as temperature and vibration of the device. This should be compared with the actual conditions of installation.
5. Cost of renewal tubes and sources from which they are available.
6. Whether or not the device serves a function which only electron tubes can perform. Often a simpler, mechanical or non-electronic device is available which requires less maintenance time and expense.
7. Power handling capacity of the relay, if it is a relay device, should be compared with the actual load to be imposed on it.
8. Efficiency of the device. Tubes and lamps age gradually before final failure. Lenses and mirrors may not always be efficient as when new and clean. Atmosphere may be full of fine dust.
9. Grade of insulation on low power circuits. Moisture must be considered. A phototube passes only a few microamperes. Hence any leakage because of reduced resistance may be serious.
10. Adequacy of construction.
11. Sturdiness of construction.
12. Ease of removal of parts for maintenance.
13. Space required for mounting.
14. Cost and maintenance.

The method of installation depends entirely on the device. But the following points should be borne in mind.

1. Provide good ventilation.
2. Locate tubes and control equipment accessible for servicing and adjustment.
3. Do not subject tubes to unnecessary vibration.
4. Use minimum length of leads and adequate grounds.
5. Follow manufacturer's instructions and recommendations.
6. Ask advice from manufacturers' service department if in doubt. Often equipment is ruined or improperly installed by "know-it-all" mechanics who are too proud to ask questions.

Photoelectric devices require more attention when being installed than electronic power devices. Phototube current is in micro-amperes. Insulation resistance of wiring must be kept very high. Leads from phototube to control should be as recommended by manufacturer and preferably run in grounded conduit. Phototube should be as near as possible to control box. Ambient temperature for amplifier tubes should not exceed 110 deg. F., and for phototubes, 140 deg. F.

Specific values for testing the numerous tubes cannot be listed in this limited space. But some general suggestions can be made as to the method of testing. Portable instruments that will be helpful in testing electronics devices are—d.c. milliammeter with scales 0–10, 0–25, and 0–100; d.c. voltmeter with two or more scales to cover a range from 0 to 750 volts, and having a resistance of 1,000 ohms or more per volt; a.c.-d.c. voltmeter with scales to read from 2.5 to 750 volts; an ohmmeter having a capacity up to approximately 100,000 ohms; and the necessary a.c. and d.c. ammeters with transformers for regular power measurements. If a number of electronic devices are used in the plant, a good tube tester should be included in the maintenance department's equipment. Unfortunately, testers for all types of industrial tubes are not available, but parts may be assembled.

In making tests, first check the filament or heater voltage and see if it has the rated value. Then check the plate or anode current by connecting a milliammeter of adequate scale, in series with the anode connection of the tube. This value of plate current should agree with the manufacturer's recommendations, and should never exceed the maximum rating.

A check, or mutual conductance test of the effect of grid voltage on plate current is very revealing for triodes, tetrodes and pentodes, but this test is not used widely for maintenance purposes.

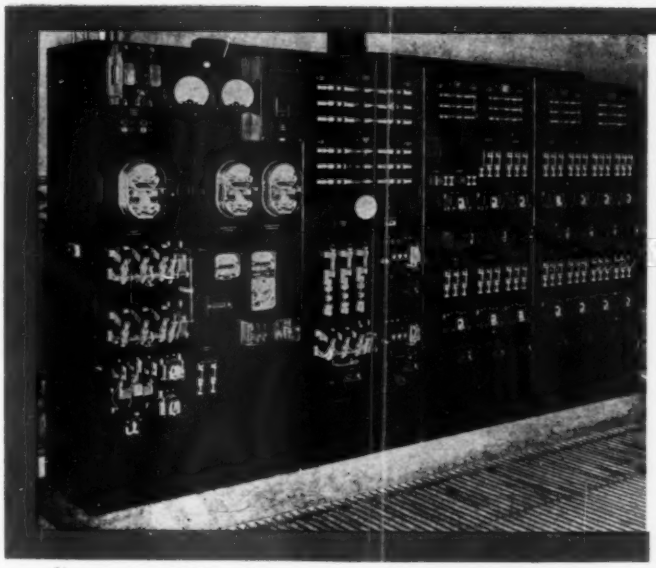
Maintenance

Electronic tube equipment varies in design, electrically and mechanically, for the numerous applications. But the following simple rules will be helpful in keeping the equipment in operation.

1. Carefully read and follow instructions issued by the equipment manufacturer.
2. When tubes are received, test them in the equipment in which they are to be used.
3. Inspect and test plate current of tubes at regular intervals, preferably every month or oftener if they have 24-hour duty service.
4. Keep a record of the plate current. Be sure the filament or heater voltage is the same each time the tube is tested.
5. When plate current begins to fall off, replace tube before it "goes sour."
6. Inspect connections and mechanical parts for looseness, and tighten them.
7. Keep the installation free from dirt and moisture.
8. If trouble from burned-out tubes is common, keep a record of filament voltage and of variations in line-supply voltage over a 24-hour period. Use a recording voltmeter if it is available.
9. Inspect water-cooling and vacuum-pumping systems periodically.
10. Maintain free circulation of air about the device and particularly the tubes.
11. As most bulbs become very hot during operation, do not let them come in contact with any metallic object nor be subjected to drops or spray of liquid.
12. If equipment is subject to vibration, use a shock-absorbing mounting.
13. Clean lenses and mirrors of photoelectric equipment regularly.
14. Avoid extraneous light to phototube, directly or by reflection.
15. Inspect relays and contactors more frequently than similar devices used with motors. The former operate at higher speed and more often than the latter.

Tubes, like lamps, are a replacement item. Spares should be kept in stock, when practicable. If they are kept for long periods, make a check test at least every three months. The maintenance man's records should include outlines and dimensions of the devices, connection diagrams, and a list of the kinds and types of tubes, including a notation as to where used and renewals.

***SMOKE CONTROL**—Equipment consists of a lamp unit shining a ray of light through smoke stack to an electric eye mounted on the other side. When smoke passes through the stack, an alarm is sounded in the boiler room. (Photobell Corp. photo)*



"3C" CONTROL BOARD

for SEWAGE TREATMENT PLANT, designed for 15,000 POPULATION based on sanitary flow of 100 GALLONS per capita.

This four panel "3C" Control Board controls 200 G.P.M., 600 G.P.M. 1250 G.P.M., and 1500 G.P.M. Pumping units. These in turn are float controlled by a Clark multi-contact Float Switch, so that the capacity sequence may vary from 200 G.P.M. to 3500 G.P.M. in accordance with the demand.

A 30 H.P. gas driven generator is operated with the gas obtained from the sludge.

On this Clark Control Board is mounted all the necessary equipment for controlling and recording the operation of all mechanical units. It is also designed to throw over automatically and utilize energy from a private utility when the gas supply is insufficient to operate the generator.

Sewage treated varies from .6 to 1.95 million gallons per day. 10 hour daily use of gas engine generates about 60 K.W. The plant uses about 140 K.W. daily. 85% of the total power is used in raw sewage pumping ahead of the plant.

Your water and sewage treatment electrical control problems will receive prompt attention at our nearest office.

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

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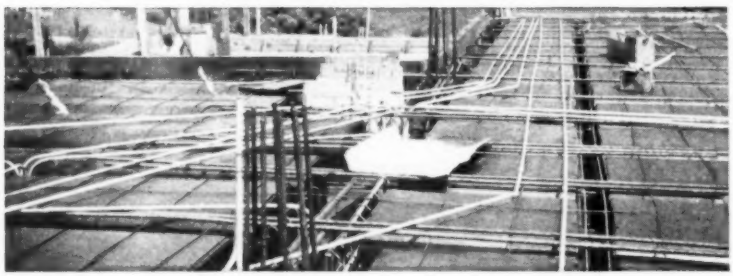
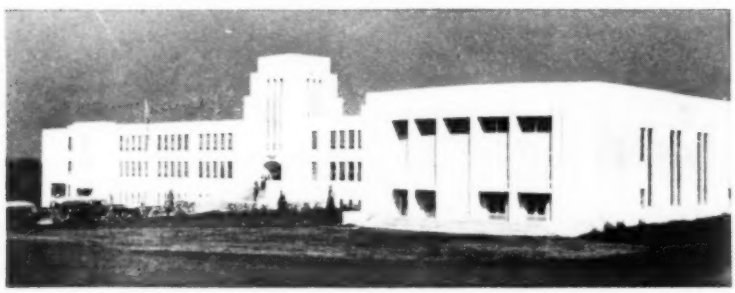
Wadeford Electric Company, Chicago, installed 98,000 feet of Steeltubes, sizes ½" to 1", exposed and in concrete fill, in this new million-dollar Senior High School Building at Appleton, Wisc. Architects: Eschweiler and Eschweiler. Associate Architects: Smith and Brandt. Electrical Engineer: Roy Dunst, Milwaukee.

These
ARE WIRED-O
STEELT



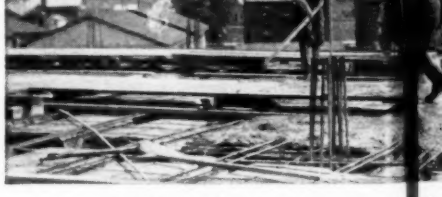
Contractors who have used Steeltubes bury it in concrete without any hesitation. They know from experience that the smooth joints, kinkless bends and patented knurled inside surface will help to make wire pulling an easy matter.



The electrical raceways in this public school at Jackson, Miss., are just as modern as the design of the building. 40,000 feet of ELECTRUNITE *Steeltubes—the modern threadless rigid conduit —was installed, exposed and in concrete.*

The wiring in Hutchinson Junior C[ollege] is protected by ELECTRUNITE *Steel[tube]. E[xposed] used 30,000 feet, all sizes, exposed and sla[b]. Contractor: M. C. Foy and Sons.*

Two of the reasons why contractors and workmen prefer Steeltubes for concrete jobs are illustrated in this photo. Note the long bent runs. With Steeltubes, these can be bent and coupled in a jiffy — without turning the entire line. Note also the uniform bends — easily made with Steeltubes.



*Dump in the concrete—ram and [vi]brate—*ELECTRUNITE *Steeltubes resists the [shock] encountered in this type of construction. [Made] of hearth steel, formed cold and electric [welded] strong, sturdy tubing that can withstand [the] pressure*

Compression-type fittings make positive, non-loosening, water-tight joints. There are no threads to cut—no weakening at joints—no damage to the corrosion-resisting galvanized surface.

e hool jobs

ED-ONOMICALLY AND WISELY-WITH

LTBES IN CONCRETE

unior Robinson, Kans., TE Steeley Electric Co. osed and slab. General ons.

am and into place—sts the and abuse en-ruction of tough open-d electric welded into an with e punishment.

● **ECONOMICALLY —** because the cost of this modern threadless rigid conduit, including fittings, is less than that of old-style conduit.

WISELY — because ELECTRUNITE Steeltubes is the ideal raceway for concrete slab construction. It is strong and tough, yet remarkably easy to handle and install — especially so in narrow spaces between pans, in long bent runs and in other difficult places. It takes up less space in shallow slabs.

Try ELECTRUNITE Steeltubes on your next job, exposed or in concrete. Learn from experience how easily it works and what a sound raceway system it provides.

Look for this label. It is found only on genuine ELECTRUNITE Steeltubes.

Steel and Tubes, Inc.

CLEVELAND . . . . OHIO

SUBSIDIARY: REPUBLIC STEEL CORPORATION

In installing the electrical system for the Herzog School, St. Louis, Mo., (a concrete job) Frewder Electric Co. used 75,000 feet of ELECTRUNITE Steeltubes.

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Production Up and Costs Down

As a result of improved lighting in the upholstery department of the B. P. John Furniture Corp., Portland, Oregon, both employees and employers are benefited. When measured with the sight-meter, the light intensity in the department formerly ranged from 5 footcandles near the windows and skylight to less than ½ footcandle a few feet away. Now the sight-meter reading is consistently between 10 and 15 footcandles. Each new lighting fixture consists of a wide-angle shallow dome reflector and a 150-watt lamp. The fixtures are placed 8x9 ft. apart and mounted 10 ft. from the floor.

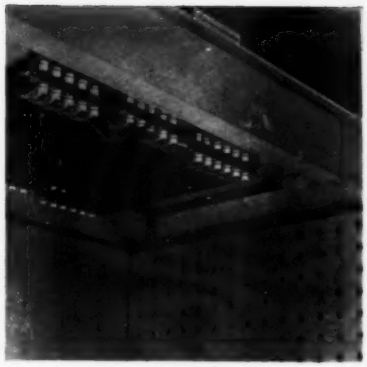
The workmen are particularly pleased with the increased lighting because (1) tacking or sewing requires less visual energy and can be done with greater speed; (2) color contrasts are quickly distinguishable; (3) floor and articles being upholstered, are no longer in shadow, but well lighted; and (4) the department is a much more cheerful and comfortable place to work. The increase in lighting has resulted in increased production and decreased operating costs—an aim in every plant.

BEFORE—*Drop lights supplied illumination which ranged from ½ to 5 footcandles. Note the shadows on the work.*

NOW—*Modern lighting provides 10 to 15 footcandles for this upholstery department. The workmen can do a better job in shorter time.*

"Strip" Heating Saves Space in Oven

Electric heating units of the strip type to speed the drying of painted and enameled parts are used in ovens manufactured by the Porbeck Manufacturing Co., St. Louis, Mo. The interior of each oven has a space of 190 cu.ft.



STRIP HEATERS—*Thirty four* 1,000-*watt heating units, connected* 3-*phase,* 440-*volts,* 60-*cycles in this* 190-*cu.ft. oven provide a maximum temperature of* 450 *deg. F., with two air changes per minute possible.* (*General Electric Co. photo*)

It is heated by 34 one-kilowatt strip units which are connected in parallel by special bus bars. Unsightly and dangerous crossing of wires is eliminated by offsetting the strip terminals by about ¾ inch. This new arrangement saves heating space and contributes to low cost as well as high efficiency.

Bus bars are formed to fit snugly over the terminal studs and resemble long strips of perforated ribbon tape. The heaters may be spaced at any desired intervals. Heat up to 450 deg. F. can be obtained, although the ordinary drying temperature is about 400 deg. F. In this "cross-current recirculation oven" provision is made for two complete air changes per minute.

Pumping Doubled, Costs Reduced

An important annual saving was made by the Delaware and Hudson Railroad through the installation of automatic electric pumps in place of steam pumps in a number of pumping plants.

A typical installation was one at Cobleskill, N. Y., where water was raised from the river to a 100,000-gal. wooden wayside tank. When steam pumps were used, the average consumption for a 24-hr. day was 100,000 gal. Operation required the services of two men, each working one 8-hr. shift.

When the change-over was made, a pump-house was built, housing two 2-in., 14-g.p.m. centrifugal pumps. Each pump was driven by a 15-hp., 220-volt, 3-phase motor and the control included a start-stop float switch. The original water tank was retained.

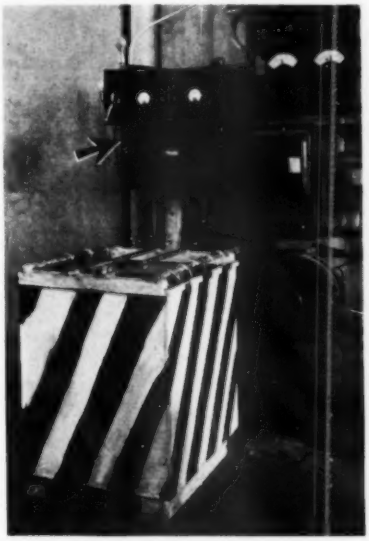
Cost of installation was $6,605. Now

the pumps supply an average of 201,000 gal. of water per day. Although the water consumption has doubled, the cost of operation has been approximately $705 per year, a saving of $2,850 annually.

Silver-Plating with a Rectifier

At the River Works of the General Electric Co., in West Lynn, Mass., a G-E copper-oxide rectifier has been in operation for two years. It is rated up to 5 volts and up to 50 amperes. The equipment provides direct current for a silver-plating operation, used to plate switch contacts, traffic control devices, and a number of other parts.

Outstanding feature of this particular rectifier is its easy and fine adjustment

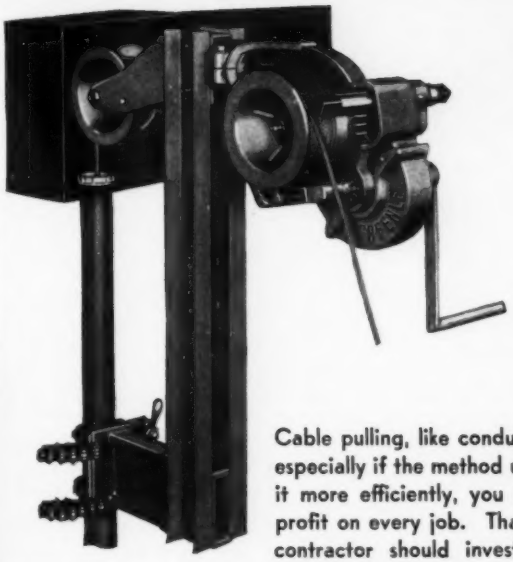


SILVER-PLATING—*In this operation easy and fine adjustment of direct current is obtained by the use of a copper-oxide rectifier. The rectifier is mounted directly above the plating tank, and has required no servicing in its two years of operation*

of current. This feature allows the outfit to be used for silver plating devices and equipment sold to the U. S. Army. The Army specifications are very exacting. It is only the unusually fine adjustment offered by this rectifier that enables the workmen easily to determine the thickness of silver deposited on the object which is being plated.

The rectifier has demanded no servicing in the two years during which it has been operating. Freedom from servicing is one feature which makes copper-oxide rectifiers superior to motor-generator sets. Past experience with m-g sets at the West Lynn plant has proved this fact.

Efficient Cable Pulling
ADDS TO PROFITS ON EVERY JOB



GREENLEE
Cable Puller
PORTABLE
POWERFUL
CONVENIENT

Cable pulling, like conduit bending, is expensive,—especially if the method used is obsolete. If you do it more efficiently, you cut costs and add to the profit on every job. That is why every progressive contractor should investigate the new Greenlee Puller shown above.

Here is a tool that is in a class with Greenlee Hydraulic Conduit Benders as a time and labor-saving device. It is easily clamped right to the conduit through which cable is to be pulled, preventing the loosening of hangers. The drum can also be used as an ordinary winch, since it is detachable and has a base provided on it for bolting to a plank. It weighs only 170 pounds, has two speeds, and will exert a pull of 7500 pounds.

Do You Have a Copy of Catalog 31E?

If you have a copy of the Greenlee Tool Catalog, No. 31E, turn to page 32 for a description of this new cable puller. If you haven't a copy, ask for one now. This catalog also includes Hydraulic Conduit Benders, Knockout Punches and Cutters, Joist Borers, Spiral Screw Drivers, Automatic Push Drills, Electricians' Bits, Bit Extensions, Hydraulic Pipe Pushers, and Copper Tube Benders.

GREENLEE TOOL CO.
ROCKFORD, ILLINOIS

GREENLEE TOOL CO., Rockford, Ill.
☐ Please send information on your Cable Puller.
☐ Would like to have a copy of Catalog No. 31E.
Name.....
Address.....
City..... State.....
My Jobber is.....
EC 7-39

UMI

"AMAZING

—THE WAY THIS DRILL GOES THROUGH CONCRETE, TILE, ETC."

THAT'S what users everywhere are saying about Carboloy Masonry Drills—the most outstanding drill development ever introduced for drilling concrete, brick, tile, porcelain, slate, etc. A Detroit General Contractor writes "We drilled 350 holes, installed anchors and pipe straps with 2 men in 7 hours. It's the best drill made!"

A Massachusetts electrical contractor* says: "We drilled a ⅝" hole through 4" of 2-year-old hard concrete in 3 minutes."

"Better Than Diamonds!"

A New York City heating contractor* writes: "Drilling through particularly hard tile, Carboloy drills stood up better than diamond drills."

An airport superintendent* says: "Seldom needs sharpening. Cuts our drilling time 95%!" (*All names on request.)

50% — 75% FASTER!

LASTS 50 TIMES LONGER! SAFE ON FRAGILE WORK! QUIETER!

HERE'S WHY:—Carboloy Masonry Drills drill faster, cleaner, more accurate holes because the cutting edge of each drill is tipped with Carboloy—a metal many times harder than any material you drill and far exceeding the hardness of even the hardest steel. You use Carboloy Masonry Drills in your Portable Electric in the same way that you have been using ordinary drills BUT you get more holes per drill, and do the job in 50% to 75% less time! Quieter! No costly spoilage on fragile work! No slow, monotonous chiseling!

Make an extra profit on your jobs. See your dealer or write for leaflet.

Write today for Leaflet

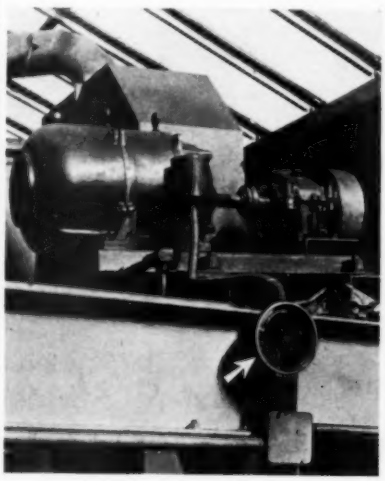
CARBOLOY COMPANY, INC.
11135 E. 8 Mile Street
DETROIT, MICH.

CARBOLOY
Masonry Drills

A Modern Method for Checking Motor Circuits in Operation

1. TAKING ADVANTAGE *of the new handy socket, A. L. Tripp, Assistant Electrical Engineer for Link-Belt Co. prepares to make a test of a motor circuit in the Chicago foundry. A screwdriver is the only tool required to remove the glass socket cover.*

2. READINGS *are made in a few minutes, with a test jack plugged into the socket and an extension cable connected to the analyzer, with its four instruments in one case. Sockets and analyzer facilitate tests, without interference with foundry operations.*



3. HANDY SOCKETS *for plugging in test instruments are included in each motor circuit of sand handling equipment installed by Link-Belt Co. in its Chicago foundry. The engineering department desires a careful check of the equipment in operation.*

4. ATTACHING ANALYZER *as it would have been done without sockets. Mr. Tripp unbolted dust-tight cover on starter and began making connections. After 20 minutes work, the hook-up looked like this. Compare this method to that shown in illustrations* 1 *and* 2.

IN many plants, instruments are being used continuously with machines in production work. They show fluctuations in load indicating variations in speed, or need for renewing dull cutting tools or polishing parts that may be overloading the motor.

Previously complicated connections were required to attach the analyzer. Now convenient, easy plugging in of instruments makes readings available within a few minutes. Sockets as shown in these Westinghouse illustrations, are usually installed near the motor but they may be inserted anywhere on the circuit.

Time Control Helps Spot Welding

Successful spot welding with dissimilar combinations of the non-ferrous group of metals, is difficult if not impracticable. According to H. Thomasson, welding engineer, Canadian Westinghouse Co., Ltd., however, the ignitron spot welding timer, with its accurate control of the current timer, makes combinations such as 18-8 stainless to nickel silver, bronze to mild steel or galvanized iron, brass to bronze or nickel silver, and many others, a simple matter. Metals such as aluminum, lead and zinc are readily spot welded to themselves.

Using "Cupaloy" a copper-chromium alloy as welding point material in a 100 kva. press type welder, which has a 12-in. depth of throat, the metals and combinations shown in the two tables were successfully spot welded in a single 6-hr. developmental period. Point diameter was carefully held to $\frac{1}{4}$ in. The currents used were 60 cycle, with a 440-volt primary. Pressures given were obtained by means of a pressure meter. Tables I and II list the metal or combination of metals together with the number of cycles applied, the percentage of the machine capacity used and the point pressure.

Each sample was tested as made. No weld was considered as accomplished until the spot produced had first class appearance, free from burrs, feathers, serious discoloration or indentation, and which on a test to destruction pulled

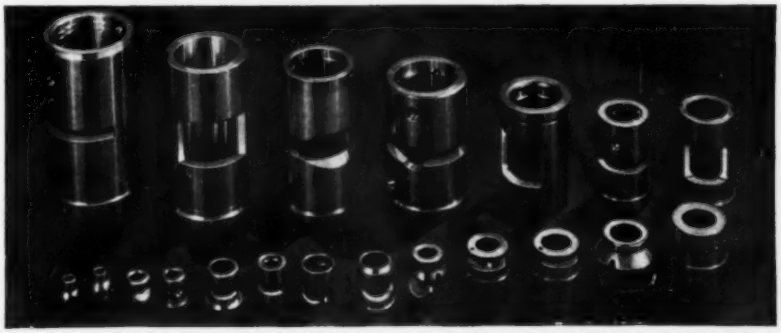
TABLE I. Metals Welded to the Same Material and Thickness

Metal	No. of Cycles Applied	Percentage of Machine Capacity Used	Tip Pressure in Pounds	Sample Number
0.025 Aluminum	1	63	400	2
0.0625 Aluminum	3	75	400	3
0.125 Aluminum	5	88	400	1
0.020 Sheet Lead	1	7	125	4
0.0625 Sheet Lead	1	18	200	5
0.125 Sheet Zinc	5	80	300	6
0.050 Sheet Brass	4	57	500	9 & 10
0.0625 Sheet Brass	4	80	500	7 & 8
0.032 Nickel Silver	2	18	400	23
0.032 18-8 Stainless	1	7	650	20
0.093 Tinned Everdur	5	57	500	14
#26 Gauge Gal. Iron	2	57	450	21
#20 Gauge Gal. Iron	2	62	500	22
0.010 Tinned Sheet Iron	2	70	470	11
0.010 Tinned Sheet Iron (Three pieces, center one corrugated)	2	88	470	12
0.040 Sheet Steel	3	7	470	18
0.050 Sheet Steel	3	7	470	16
0.0625 Sheet Steel	3	13	470	19

BUNTING Bearing Quality

ELECTRIC MOTOR BEARINGS

● When you install a Bunting Special Alloy Electric Motor Bearing you assure smooth, quiet operation and long life under all conditions of use. These perfected bearings are obtainable from stock for all makes of motors from 1/50 hp to 100 hp. Write for catalog arranged to facilitate ordering . . . The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.



TELESCOPE BM SYSTEM

CONNECTORS AND COUPLINGS

Cadmium Finish for Electrical Metallic Tubing

B-M Connectors and Couplings make the neatest installation. No nuts to tighten, just two squeezes with our Indenter and the fitting is securely fastened to the tubing.

B-M fittings are so much lower in price that the savings on the first job will more than pay for the Indenter required. Our tools and method of fastening the fittings to the tubing are patented, and we limit the license of our tools under these patents to the installation of our fittings only.

Listed by Underwriters

No. 605 Price $1.35

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THE M. B. AUSTIN CO., Chicago, Illinois
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GALVA, ILLINOIS

NEW!

TRICO

Unbreakable
OILERS

MODERN! STREAMLINED!

For maintaining a constant level of oil in ring or ball bearings, pump and gear housings, etc.

WRITE FOR BUL. No. 25

Trico Fuse Mfg. Co. Milwaukee, Wis.

UMI

Wagner Motors

are diversified to fit varying requirements

Misfits are costly. Overmotoring to obtain the required starting torque increases first cost and causes inefficient motor operation. Undermotoring to save on first cost causes short motor life.

Wagner motors are so diversified in types and ratings that usually there's a Wagner motor already available with the proper electrical and mechanical characteristics to exactly meet the requirements of the job.

SINGLE-PHASE MOTORS

Wagner single-phase motors are available in repulsion-start-induction, repulsion-induction, split-phase, capacitor-start capacitor-run, capacitor-start induction-run, permanent-split capacitor, and shaded-pole-fan motors. They can be varied mechanically to suit the requirements of the job: vertical or horizontal; rigid or resilient mountings; open, drip-proof, or explosion-proof frame construction; double-shaft extensions, etc. Described in Bulletins 177 and 179.

POLYPHASE MOTORS

Wagner polyphase motors are available in all standard sizes up to 400 hp. They are available in seven types of single and multispeed squirrel-cage motors, slip-ring, self-excited, synchronous (Fynn-Weichsel). Described in Bulletin 182.

In addition, the Wagner line of motors includes direct-current motors, available in both appliance and industrial types.

Write for free bulletins—they will be a definite help in applying the right motor to each job. And feel free to consult a Wagner sales-engineer at any time. He will be glad to make helpful, unbiased recommendations.

M39-15

Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.
Motors Transformers Fans Brakes

TABLE II. Metals Spot Welded to Other Metals and Thicknesses

Metal	No. of Cycles Applied	Percentage of Machine Capacity Used	Tip Pressure in Pounds	Sample Number
0.050 Brass to 0.050 Olympic Bronze	4	57	450	15
0.062 Brass to 0.062 Olympic Bronze	4	63	500	13
0.050 Brass to 0.0325 Nickel Silver	3	57	450	24
0.050 Olympic Bronze to 0.032 Stainless Steel (18-8)	2	18	550	26
0.050 Olympic Bronze to #20 gauge Galv. Bronze	4	67	500	27
0.050 Olympic Bronze to 0.050 Sheet Steel	2	32	470	25
0.032 Nickel Silver to 0.032 Stainless Steel (18-8)	2	7	450	17
#28 Gauge Galv. Iron to 0.010 Tinned Sheet Steel	2	57	400	31
#20 Gauge Galv. Iron to 0.040 Sheet Steel	3	13	400	30
#28 Gauge Galv. Iron to 0.032 Stainless (18-8)	2	31	550	29
0.040 Sheet Steel to 0.032 Stainless Steel (18-8)	2	13	550	28
#20 Gauge Galv. Iron to 0.032 Cadmium Plated Sheet Steel	2	31	450	32

a hole in the parent stock, at least 3/16 in. in diameter.

It was found to be impractical to get a spot in the ⅛ in. thick zinc, however, which would tear the hole, due no doubt to the fact that the thickness was such as to make the circumferential cross section around the spot greater than the area of the weld. The same was true of the everdur. The zinc was the only metal in which the indentation was at all serious, running about 30% of the thickness. In no other case did this amount to more than 10%.

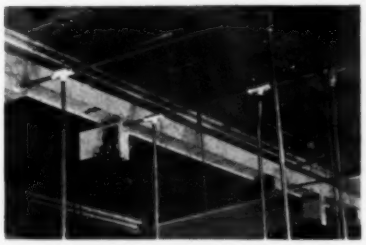
Eleven distinctly different metals in nineteen gages were spot welded to the same material. Twelve combinations of dissimilar metals were welded. It was all a direct result of the extremely short and accurate timing made available by the "Ignitron" control.

Flexible Power Aids Equipment Changes

Rearrangement of production machines to provide for changes in methods of manufacturing and types of products was unusual a few years ago. Today the procedure occurs in many plants. The electrical man's job in connection with the changes has been simplified by the use of enclosed bus distributing systems.

A typical case is in the plant of the Illinois Tool Works, Chicago, manufacturers of broaches, hobs, milling cutters, shaper cutters and special production tools. New developments in the products frequently require equipment changes on comparatively short notice.

A "Flex-A-Power" system was installed, which provides for future expansion and improvement of programs. Capacity of the installation can be doubled by adding bars to the present 1,200 amp. main bus. Branches take off at three points from the bus, and



FUSED TAP BOXES *may be installed on 12-in spacings. Electrical connection to the bus is made when boxes are moved to the horizontal. Fuses are accessible only when boxes are in this vertical position*

DISCONNECT SWITCH *is used where branch circuits take off from the main bus*

motor connections are plugged in wherever necessary along the branches. Thus the shifting of machines and the addition of new ones can be made in a short time and with little loss in production.

Tools for Assembly Work

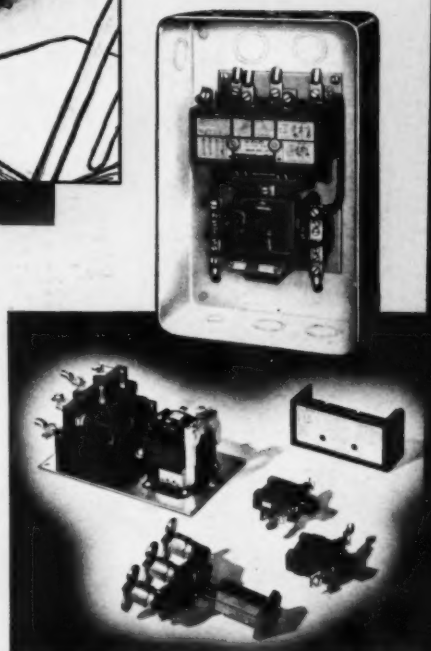
Many operations in assembly work lend themselves to the use of equipment with flexible drives. One example of a very useful application is in the production of radio sets. Power screwdrivers and socket wrenches save time and secure uniform tightness.

A somewhat similar operation is the application of screw-caps to bottles or other containers as they come from filling machines. In both cases, the driving motor may be mounted overhead and the driving shaft of the tool suspended from above.

"He says there are so few parts he can't fill up his train!"

A train load of parts in your starter may mean a train load of troubles for you. Allen-Bradley solenoid starters avoid trouble by their A-B-C simplicity. They have no complicated mechanisms to wear and cause trouble. They have no bearings, pins, or pivots to delay switch action.

Then too, the double break, silver alloy contacts on Allen-Bradley solenoid starters never have to be cleaned or filed. They are always in first-class operating condition. The efficient solenoid magnet holds in and keeps motors running in spite of poor line voltage conditions. Specify Allen-Bradley solenoid starters in your plant and bid good-bye to control troubles.



Here you see all the parts of the Allen-Bradley solenoid starter. What could be more simple?

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

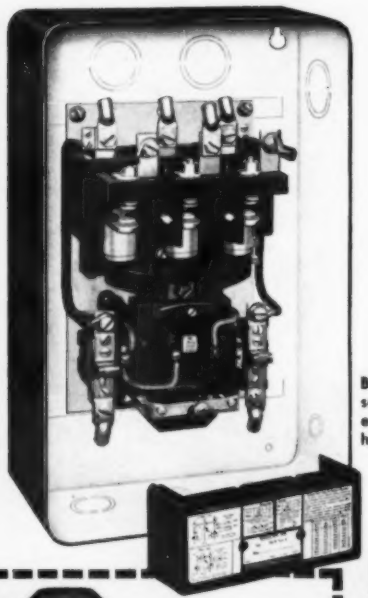
QUALITY

UMI

"What d'ya mean -no contact maintenance?"

Yes, siree! . . . that's exactly what we mean!

Don't you touch those Allen-Bradley silver alloy contacts with that file. There's no contact maintenance on Allen-Bradley solenoid starters. Why? Because any oxide formed by the arc is as good a conductor as the contact itself. You don't need to clean or file these cadmium silver contacts . . . like you do the old copper contacts. Here's our advice . . . after you install an Allen-Bradley solenoid starter . . . forget it!



Bulletin 709 solenoid starter with arc-hood cover off.

Five Other Advantages of the A-B Solenoid Starter

- **Simple Construction**
  There are fewer moving and wearing parts, assuring trouble-free operation. No bearings or pivots to gum up and corrode. No flexible jumpers to break and cause trouble.
- **Long Life**
  The sturdy rugged construction of all parts assures long life. Millions of operations are built into Allen-Bradley solenoid starters.
- **High Switching Capacity**
  These starters will easily disrupt currents of not less than ten times their maximum horsepower rating—will handle all load conditions.
- **Easy Installation**
  Ample wiring space, accessible terminals, white interiors, and knockouts on all sides and back of cabinet, make wiring easy.
- **Complete Line**
  Available in four standard sizes with a maximum rating of 30 hp, 220 v; 50 hp, 440-550 v. Enclosing cabinets are available for every industrial service condition.

Send for "The Story of the Solenoid Starter"

Allen-Bradley Co.
1307 S. First Street
Milwaukee, Wisconsin

Please send me a copy of "The Story of the Solenoid Starter."

NAME _____

COMPANY _____

STREET _____

CITY _____ STATE _____

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

To Step Up Control Sales

[FROM PAGE 11]

the plant. The reason is that most plant managers know nothing about the better types of enclosures and so they simply order a standard starter. Why not acquaint them with these safer enclosures?

These are available—

General purpose enclosures—These are the "standard" enclosures for industrial service.

Dust-tight enclosures—(with gasket)—For installations in which metal and other non-combustible dusts may filter into the ordinary enclosure and cause starter trouble.

Dust-tight enclosures—(with machined joint)—For hazardous locations, as in flour mills or grain elevators.

Water-tight and weather-proof enclosures—For creameries, launderies, tanneries, paper mills, packing plants, outdoor installations or any place where water may be sprayed over the starter.

Explosion-proof enclosures with air-break contacts—Approved for use in hazardous gas locations, such as dry cleaning establishments, gasoline filling stations, or lacquer rooms.

Explosion-proof enclosures with oil-immersed contacts—For the special requirements of chemical plants in which corrosive gases are present. The contacts are permanently immersed in an oil bath.

For the usual run of starter sizes, the sale of this better equipment means doubling the billing for water-tight enclosures. And when you sell an explosion-proof starter, your billing goes up from 200 per cent to 300 per cent.

Point No. 3—Sell push button control.

When you sell an automatic magnetic starter in place of a hand-operated starter, that is the beginning of an almost unlimited opportunity to add other control stations. Frequently one or two single-button emergency "stop" stations are highly desirable. In other cases, two or three "start"and "stop" stations can be used advantageously to permit controlling a machine from several points. Then there are other cases requiring combination "automatic" or "hand" control or push button stations with tell-tale lights, especially if some switches control heater circuits, remote fans and blowers and temperature controls.

Most plant mangers are inclined to feel that anything other than a standard hand-operated starting switch is "special" and therefore too costly to consider. Educate these men to realize that virtually hundreds of combinations of push-button control are now available from stock as "standard" material. For example,

"Single-button" nameplates, taken at random include—"Start, Stop, Jog, Reset, Forward, Reverse, Raise, Lower, Up, Down." For "two-button" stations: "Stop-Run, Stop-Start, Slow-Fast, Open-Close, Raise-Lower, Off-On," are already standard. For stations with three or more buttons and with lever switches, many standard nameplates are available with various designations.

More and more limit switches are being used on machine tools, conveyors, hoists, elevators and practically every type of motor-driven machine. Precision type limit switches prevent jamming and breakage of the machine, the work or the tool. There are thousands of plants with older machine tools that need them. Here is an opportunity to cash in on profitable new business.

Point No. 4—Push combination starters.

These units combine in one cabinet the automatic magnetic starter and the hand-operated disconnect switch. It is possible to mechanically interlock the switch lever with the door lock. So that opening the cabinet automatically "kills" the circuit to the magnetic starter and motor. This safety feature is highly important in some cases.

The combination starter saves space and provides the convenience of mounting a single unit on a machine base instead of one unit on the machine and the other on the wall. This starter is highly popular where frequent changes are made in the plant layout. And the sale of a combination starter will boost the billing from 50 per cent to 100 per cent.

Point No. 5—Investigate the market for miscellaneous contactors, such as—

Reversing Switches—It is surprising how many applications exist for the double, mechanically-interlocked magnetic switches known as "reversing switches". To be completely safe, reversing switches must be mechanically interlocked.

Multi-Speed Motor Starters are rapidly assuming an important place in the control field. The separate-winding and consequent-pole types of motors, now supplied by motor manufacturers, give two, three and four speeds. When controlled by a modern push-button system, these motors offer many advantages.

Small Magnetic Contactors—Many industrial plants build elaborate production lines involving continuous baking ovens, moving belts, cycling machinery, and other units requiring small contactors or relays for their progressive or individual control. It would be impossible to enumerate the hundreds of applications developing daily. The engineering involved is not difficult.

Point No. 6—Make money out of voltage fluctuations.

Tackle the jobs that are giving trouble due to the sudden inrush of starting current or because the abrupt application of torque to driven belts, chains or gears causes needless wear and tear on the machinery. Serious lamp flicker also can be avoided with a resistance starter used in the primary or stator circuit of the squirrel-cage motor. Look over your territory and note the installations now served by compensators. If there is a current-inrush problem, you have the answer in several types of resistance starters. And where public utilities have strict rules for operating motors on "network" systems that combine power and lighting, sell the "network starter" to keep the starting current within prescribed limits.

Are these applications worth your attention? Well, resistance starters will bill for $100.00 to $160.00 in the smaller sizes. Network starters will run to $225.00 and $325.00 for comparable units. Such sales are worth some extra thought and engineering.

Point No. 7—Sell synchronous motor control.

Many plants have power loads that justify synchronous motors for certain drives. But in the past, there has been apprehension about starting synchronous motors satisfactorily. Today there are fully automatic synchronous motor starters. Anyone can start the motor and synchronize it without difficulty.

The control for a synchronous motor may run from $450.00 to $4,000.00. So for the seventh point of using normal sales opportunities in motor control, capitalize on power factor correction by selling synchronous motors with automatic motor starters.

The moral is: Give motor control special sales effort—and it will repay you in new customers and bigger profits.

Blue Prints For Many

Visitors to the Indianapolis "Electric Home Complete" were given novel blue folders showing the electrical layout for each floor of this home. While this idea was developed to drive home facts about adequate wiring, these blue prints also suggested the logic of having electrical layouts clearly shown on the owner's plans.

UMI

Questions ON THE Code

Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

Conflict in Services for Small Homes

Q. *"In following a wattage schedule set up by local ordinance to supplement the National Electrical Code, we find ourselves in a controversial position with the State Inspector when we apply this schedule in outside (N.E.C.) territory. It is in regard to the capacity of associated service equipment.*

A dwelling occupancy, having an area of 631 square feet, was connected on three 15 ampere branch circuits. The Inspector contends that two-wire, 30 ampere service equipment, violates section 2357, N. E. C. In determining the load, we applied section 2107a, allowing two watts per square foot, plus 500 watts for the kitchen and 500 watts for the breakfast nook (no laundry) to reach a total of only 2262 watts. We contend that the use of three 15 ampere branch circuits has no bearing in determining the total load, nor the capacity of service equipment.

The utility operating in the territory in question, will not under any circumstances, connect a building of the above size and load characteristics on other than a two-wire basis.

The service equipment used is of a type in which the fuse panel (4 circuits) is built as a component part of the service switch. This equipment is labeled by the "Laboratories" as approved service entrance equipment.

Your opinion will be awaited with great interest."—M. C. K.

A. It is true, that with an area of 631 square feet, two 15 ampere branch circuits would satisfy Sections 2107a and 2108 of the Code.

However, the Inspector is correct in objecting to the 30 ampere service switch for three branch circuits, since section 2357 prohibits the use of 30 ampere service switches, without special permission, where a two-wire service supplies more than two branch circuits.

There is no doubt but that the intent of the rule as well as the safety of the installation could be just as well served if the rule was revised to read: "Where sections 2107 and 2108 require the use of more than two 15 ampere branch circuits on equipment served by a two-wire service, 30 ampere switches shall not be used." This would permit the use of more circuits without penalizing the better construction.

Devices for this special purpose have been approved by Underwriters' Laboratories and are listed by them. These devices are specially noted as being "For use only by special permission of the inspection authority having jurisdiction."

Additional Circuits

Q. *"In cases of a farm dwelling using a 60 amp. service switch with two sets of pull type fuse holders and four 15 amp. branch circuit cutouts, with entrance conductors of two No. 6 and one bare No. 8, with computed lighting load at 20 amperes, supplied from the 4 branch circuit fuses on the entrance switch, what is the proper manner of connecting additional circuits without using either the range tap or the hot water heater tap? Would these additional circuits require additional switches?"*—G. C. P.

A. Our inquirer sent the manufacturer's sketch of the service entrance switch referred to above. Here we see that the right-hand side pull cartridge fuse switch, on the service line side, is a main service switch. This switch controls and feeds the range switch (also a pull fuse switch) and the four 15 amp. branch circuit fuses, No. 1, 2, 3 and 4 and also the taps A and B. The fuses on the range switch furnish protection for the range circuit and the plug fuses furnish protection for the branch circuits No. 1, 2, 3 and 4. But the taps A or B supplying the line marked "water heater" are not provided with any protective devices and proper fuses must be provided outside of this switch enclosure and immediately adjacent to it.

Of course, it is possible that the range and the four branch circuits will require all of the capacity of the service equipment and that there will be therefore no remaining capacity to feed a water heater. In this case heavier service equipment and also heavier service conductors would be necessary.

If it is desired to use one of the switches on this device for a range and the other one to control the water heater, then a separate service equipment must be installed.

RURAL INSPECTOR T. H. Sederwall handles farm wiring inspections on three REA cooperative projects in Western Illinois. In Macomb he visits the State Electrical Show to straighten out rural contractors and farmers on their wiring problems.

Switches in Bathroom

Q. *"What switches should be used in the bathroom—single or double pole and location?"*—N. K. McA.

A. The National Electrical Code does not cover bathrooms specifically but does cover certain conditions generally. If the circuit is wired with armored cable or conduit the switches must be installed in grounded boxes. In this case the Code permits the use of metal switch plates.

If the premises are wired with open wiring, knob or tube wiring or nonmetallic sheathed cable, however, the switch boxes would not be grounded unless a separate grounding wire was used. Under these conditions the switch plates, if within reach of conducting floors or other conducting surfaces, must be provided with covers of non-conducting material. This requirement is found in Section 3809.

If, in the above case, the switch boxes were grounded by means of a

PROTECT Your Time-switch Profits

G-E TYPE T-27

A general-purpose time switch for contractors who know the advantages of low maintenance

WITH a General Electric Type T-27 time switch, your installation profits are protected—they aren't cut in on by constant servicing. And every feature of the Type T-27 is designed to assure day-after-day performance.

The Type T-27 is a general-purpose time switch—the only one that uses the Telechron motor drive of America's best-known electric clocks. You can be sure of the time switch dependability your customers demand.

Its quick-make, quick-break, solid-silver contacts are conservatively rated at 35 amperes. They resist oxidation; they're self-aligning, self-cleaning. That's another reason why there's minimum maintenance with Type T-27.

It's easy to install the Type T-27. Five standard knockouts simplify your wiring job. Finally, the ready acceptance of the G-E monogram as a symbol of reliability provides you with another selling point.

To learn more about the features of G-E Type T-27 time switches, call the nearest G-E office or write for Bulletin GEA-1427H. General Electric, Schenectady, New York.

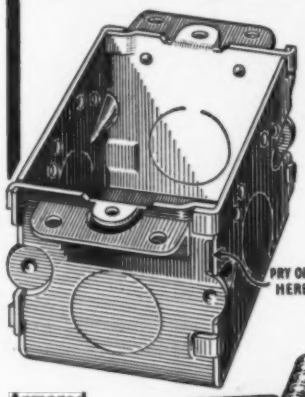
GENERAL ELECTRIC

440-124

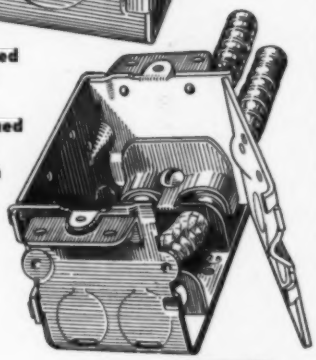
UMI

PAINE SWITCH BOXES

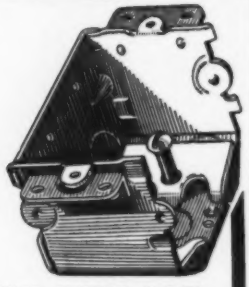
Like all Paine Products, Paine Switch Boxes have certain patented and exclusive features that make them superior to similar styles and types available on the open market. For that reason always play safe, assure yourself of the best available for satisfaction and ease of installation, *at no additional cost.*



Rigid Conduit Switch Box



Armored Cable and Sheathed Cable Switch Boxes



Loom Switch Boxes

PAINE SECTIONAL SWITCH BOXES are fully approved by Underwriters' Laboratory.

Check the following features for advantage and ease of installation:

1. **GANGABLE**—supplied in any size or style to fit your requirements.
2. Nail holes in side—a Paine feature.
3. Clamps out of way for easy insertion of cable.
4. Ample wiring room.
5. Bushed holes always perpendicular—does away with spreading or bending when tightened around cable.
6. Visible opening for Anti-Short Bushings.
7. Strong, Rigid Sides—pry off easily, snap on quickly, hold firmly.
8. Japanned or galvanized finish.
9. Conveniently packaged in cases of 50.

WRITE TODAY FOR COMPLETE SPECIFICATIONS and Paine Catalog on Anchoring devices, and building, installing and maintenance and electrical specialties —*each an improved item.*

THE PAINE CO.

2961 Carroll Ave., Chicago, U.S.A.

Eastern Warehouse & Sales: 48 Warren St., New York

Questions on the Code

[FROM PAGE 44]

separate grounding wire, metal switch plates could be used. Or, in accordance with section 3716, non-metallic outlet boxes may be used with non-metallic covered wiring systems, in which case non-metallic covers or plates would be used in accordance with section 3706b.

The Code assumes, therefore, that it is safe to touch grounded metal boxes, covers, or switch or receptacle plates, even when in contact with other grounded surfaces and that it is also safe to touch non-metallic boxes, covers and plates, when everything is in accordance with Code rules. The Code does require that a single pole switch break the ungrounded conductor of a circuit.

Raceway Sizes for Service Conductors

Q. *"Can a combination of two insulated service conductors and one bare neutral service conductor be installed in a smaller raceway than would be required for three insulated conductors?"*—L. T. W.

A. The use of a bare neutral service conductor is permitted in some localities. Usually a table of raceway sizes for various combinations of insulated and bare service conductors is developed to guide inspectors and contractors, such as the accompanying table used in Milwaukee.

Motor on Lighting Circuit

Q. *"What is the largest size single phase 110 volt motor allowed on a 15 amp. branch circuit supplying lights?"*—F. R. B.

A. The most commonly used branch lighting circuit is 15 amp. Section 2125, b and c limits the appliances which may be connected to such a circuit to 12 amps. for portables connected to a receptacle or 6 amperes for a fixed appliance or motor. The use of motors of this size might require the selection of a proper type of overcurrent protective device to take care of the starting current of the motor.

Ground Clamps

Q. *"In the past several years we have been using heavy gauge copper straps for grounding systems up to 60 amp. installations. We have also always soldered our ground to pipes ¾-in. driven 7 ft. deep. Now we are forbidden by some utility companies to use solder on our ground and have been told to remove all copper heavy clamps and to use instead malleable ground clamps. What is the ruling on this?"*—A. L. V. A.

A. Section 2603a states that the sheet metal strap of ground clamp is not suitable for grounding the neutral conductor of an interior wiring system, unless it has a rigid metal base to seat on the water pipe and a strap of some metal which will not stretch. The copper strap type of ground clamp will not meet this requirement, hence the demand for the solid base type.

TABLE OF CONDUIT SIZES FOR COMBINATIONS OF ONE BARE AND TWO 600 V. R. C. COPPER CONDUCTORS COMPILED 1939. BY W. A. HAIG

BARE SERVICE NEUTRALS ARE PERMITTED BY RULE 2304-a.

WIRE SIZES		TWO 600 V. R. C. COPPER CONDUCTORS											
		14	12	10	8	6	4	2	1	1/0	2/0	3/0	4/0
ONE BARE COPPER CONDUCTOR	14	½	½	½*	¾	1	1*	1¼	1¼*	1¼*	1¼*	1½*	2
	12	½	½	½*	¾	1	1*	1¼	1¼*	1¼*	1¼*	1½*	2
	10	½	½	½*	¾	1	1*	1¼	1¼*	1¼*	1¼*	1½*	2
	8	½	½	½*	¾*	1	1*	1¼	1¼*	1¼*	1¼*	1½*	2
	6	½	½	½*	¾	1*	1*	1¼	1¼*	1½	1½*	1½*	2
	4	½	½	¾	¾	1	1*	1¼	1¼*	1½	1½*	1½*	2
	2	½	¾	¾	¾	1	1¼	1¼*	1¼*	1½	1½*	2	2
	1	¾	¾	¾	¾	1	1¼	1¼	1¼*	1½	1½*	2	2
	1/0	¾	¾	¾	1	1	1¼	1¼	1¼*	1½*	1½*	2	2
	2/0	¾	¾	¾	1	1¼	1¼	1¼	1½	1½	1½*	2	2
	3/0	1	1	1	1	1¼	1¼	1¼	1½	1½	1½*	2	2
	4/0	1	1	1	1	1¼	1¼	1¼	1½	1½	2	2	2*

EXAMPLE—ONE #4 BARE AND TWO #1 R. C. CONDUCTORS REQUIRE 1¼ INCH CONDUIT. THIS TABLE IS BASED ON THE 1937 N. E. C.

* These conduit sizes are smaller than those required by table 2; but nevertheless they are permitted by N. E. C. official interpretation No. 159.

IT MUST BE RIGHT

smooth sailing with TRIANGLE

TRIANGLE PRODUCTS GO PLACES

COLORADO STATE CAPITOL BUILDING ANNEX

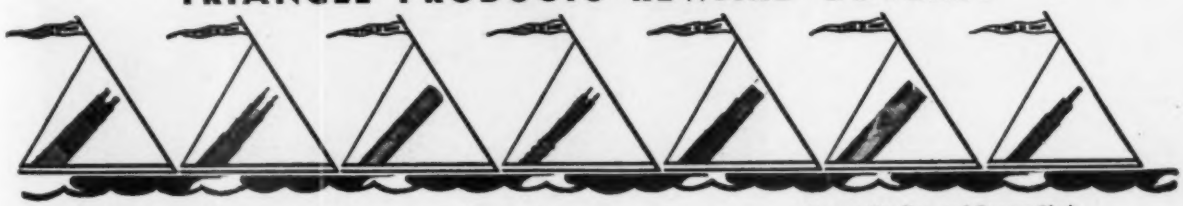
Mr. Contractor!

Deeds! Not words! ***That's Triangle!***

Sure, everybody talks Quality but the best evidence of quality is the selection of *Triangle* conduit and wire for this and similar outstanding installations!

Mark your orders: ***"Must Be Triangle!!!"***

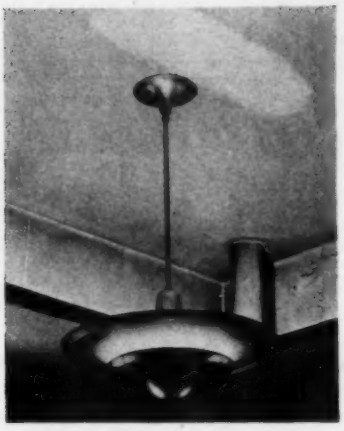
TRIANGLE PRODUCTS REWARD BUYERS!



TRIANGLE CONDUIT & CABLE COMPANY, INC.

Horace Harding and Queens Blvds.
Elmhurst, New York City, N. Y.

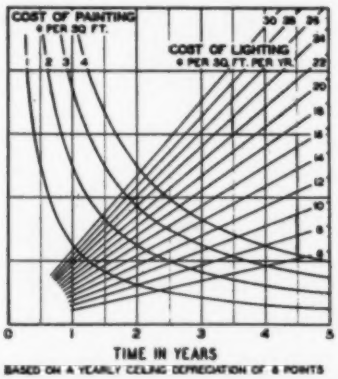
Better Lighting



LOST REFLECTION—Painted three years ago to reflect 85% of the light, this ceiling today reflects only 48%. The condition was not apparent until a section was cleaned.

WHEN SHOULD CEILINGS BE PAINTED?

Modern office lighting is usually indirect, so the ceiling itself becomes virtually a light source. When new, its matte white surface will reflect about 85 per cent of the light which strikes it. As it becomes dirty the illumination is reduced. This depreciation will rarely be less than 6 points (85% to 79%) per year, and is in many cases as much as 12 points (85% to 73%).


COST OF PAINTING
¢ PER SQ FT.
1 2 3 4
COST OF LIGHTING
¢ PER SQ. FT. PER YR.
30 28 26 24 22 20 18 16 14 12 10 8 6
0 1 2 3 4 5
TIME IN YEARS
BASED ON A YEARLY CEILING DEPRECIATION OF 6 POINTS

REPAINTING SCHEDULE — Easy method for determining how often to repaint when the cost of lighting and of painting are known.

What then is the economic loss when the reflectivity of a ceiling begins at 85 per cent and in three years time is reduced to 65 or even 50 per cent? Every month, day, and hour a little more light is being absorbed, and a larger part of the electric bill is being wasted.

A cleaning or repainting program should be set up to minimize this loss by the use of this chart. Of the three variables involved, ceiling depreciation is assumed to be 6 points a year. Costs of cleaning or repainting may be readily obtained, and lighting cost is just a matter of brief calculation. When all three are known, and applied to the chart, the most economic period of ceiling surface renewal may be obtained.

As an example, the general offices of an organization occupy 23,000 sq. ft. and the lighting is totally indirect. Electrical energy for the past year, for lighting purposes, amounted to $2,509 and lamp cost was $251, a total lighting cost of $2,760. Dividing by the sq. ft. of space, it amounts to 12¢ per sq. ft. per year. The cost of repainting the ceiling is estimated at 2¢ per sq. ft. Referring to the chart, the line representing a lighting cost of 12¢ is followed until it meets the curve representing a painting cost of 2¢. Dropping vertically from this intersection to the time scale, reveals that for this particular set of conditions, the ceiling should be regularly repainted every 2¼ to 2½ years. This might be said to represent the economic balance between cost of light absorbed and cost of maintenance.

The chart may be used just as well in the case of semi-indirect lighting. For the latter, three-quarters of the calculated lighting costs per sq. ft. per year, or 9¢, should be applied to the chart because of the proportionately less part that the ceiling plays in the lighting result. In that case the answer to the above problem would have been a 2¼ year repainting schedule.

BOTTLING INSPECTION

Critical inspection of milk bottling is the last line of defense in the dairy. Bottling and inspection in the South State plant of the Bowman Dairy in Chicago was formerly handled under 200 watt diffused direct lighting units on 16 foot spacing supplementing day-

A NEW DISPLAY—The new quarters of the Miller Electric Company in Jacksonville, Florida, include a large fixture display room for local business. All local work is handled by a department separate from the company's larger operations over the southern states. The display permits owners, architects and builders to check up on lighting needs while wiring layouts and contracts are being discussed.

Announcing the Complete New Line of...

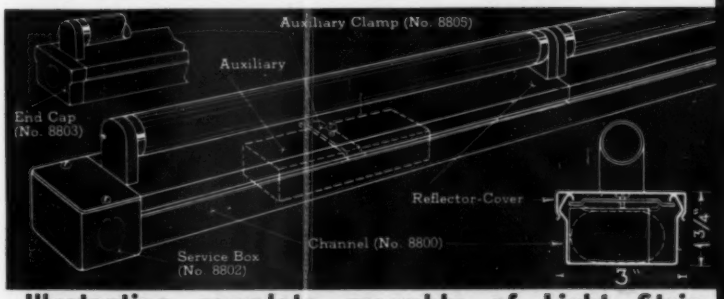
DayBrite

FLUORESCENT LIGHT STRIP AND REFLECTORS

A complete strip lighting system with snap-on reflector-covers and reflectors for 18", 24", 36" and 48" Fluorescent lamps. This system has many excellent applications. For illuminating coves, niches, luminous panels and for decorative lighting of all kinds. Also for exposed mounting in ceilings for general illumination.

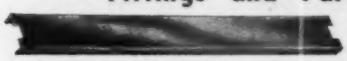
This system makes it possible to build complete fixtures for one lamp or any number of lamps that may be required for a continuous installation.

The channel is designed to accommodate any of the auxiliary control units that are now being manufactured for use with Fluorescent Lamps.



Illustrating complete assembly of Light Strip

Fittings and Parts for Light Strip

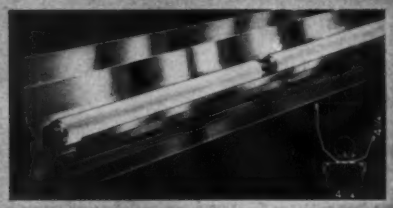


Reflector-covers for 18", 24", 36" and 48" lamps. Finished in aluminum lacquer, porcelain enamel or polished chromium.

No. 8801 Channel Coupling | No. 8802 Service Box | No. 8803 End Cap | No. 8804 Auxiliary Clamp

SPECULAR ALZAK REFLECTORS

For Use with DAY-BRITE Fluorescent Light Strip



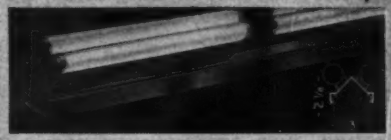
No. 8850 Series — Asymmetric Shape

No. 8855 Series — Symmetric Shape

★

TWO-LAMP REFLECTOR COVERS

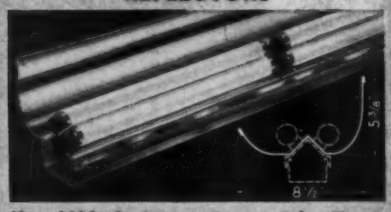
For 18", 24", 36" and 48" Fluorescent Lamps



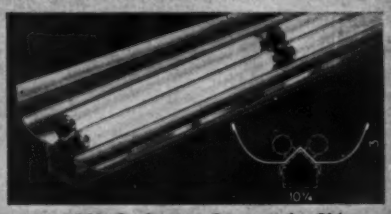
Reflector Covers are finished in Aluminum Lacquer or Chromium

★

TWO-LAMP SPECULAR ALZAK REFLECTORS



No. 8890 Series — Asymmetric Shape



No. 8895 Series — Symmetric Shape

DAY-BRITE LIGHTING, INC.
5421 Bulwer Ave. St. Louis, Mo.

WRITE TODAY

For your copy of *Catalog No. 110* on the complete *New* Day-Brite line of FLUORESCENT LAMP FIXTURES.

DAY-BRITE FIXTURES ARE AVAILABLE THROUGH ALL LEADING SUPPLY HOUSES

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STOP this with a McGILL

Adaptable Lamp Changer

Thousands of persons are killed or permanently injured each year in accidents while doing ordinary things. Climbing ladders to change lamps is a hazardous and needless task. A McGILL Lamp Changer will do the trick without risk or danger to workmen. At the same time it reduces the costs for workmen's compensation insurance, and loss of time due to personal injury.

GO for Safety

Simplicity of construction and ease of operation of the McGILL Lamp Changer may be likened to the human hand. The coil spring around the finger tips grips the lamp tightly and makes for much easier and quicker changing of lamp bulbs. A flexible joint is furnished for the smaller size lamp changer so that, by pulling the cord, the head is adjusted to any angle. This facilitates removal or insertion of lamps in sockets in almost any position. Steel or aluminum pole sections 5½ feet long are available, and fasten together with a locking arrangement to make poles any length up to 30 feet.

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Repair radios expertly

This book gives the essentials of theory and technique that clarify radio troubles and help you make quick, accurate repairs.

Just Out!

Principles and Practice of RADIO SERVICING

By H. J. HICKS

Radio Instructor, Hadley Vocational School

300 pages, 6 x 9, 212 illustrations, $3.00

INCLUDES CHAPTERS ON:
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Shows how to install, test, and repair radio receivers, giving not only instructions in all the servicing procedures, but also plain treatment of the theory of electricity and radio needed for most effective approach to servicing problems. Written in excellent self-study style for servicemen who want to improve their skill and readers who want to learn this practical field from the ground up.

10 DAYS' EXAMINATION ON APPROVAL—SEND THIS COUPON

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Send Hicks—Principles and Practice of Radio Servicing for 10 days' examination on approval. In 10 days I will send $3.00, plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittance.)

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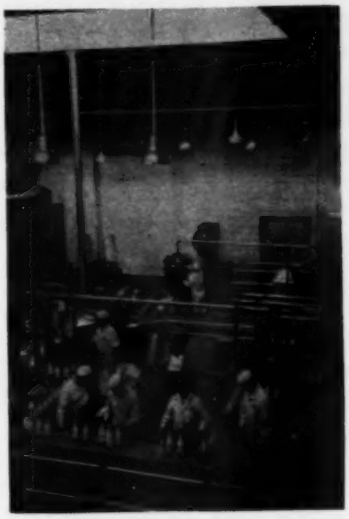
Better Lighting

[FROM PAGE 48]

light from a skylight above.

Four additional 500 watt high bay reflectors, installed over the inspection area between the general lighting units, has stepped up the illumination intensity to 25 foot candles. The reflectors are suspended on conduit stems 12 feet above the floor. More critical inspection and independence of daylighting conditions has been made possible by this installation.



SUPPLEMENTARY *lighting from four high bay units between the general lighting fixtures stepped up inspection illumination to 25 foot candles in this Chicago dairy.*

***THOSE FACTORY OFFICES**—The Cushman Chuck Company in Hartford, Conn., offers a good example of modern eye comfort for the office staff. Here the Haselton Electric Company installed fifteen Curtis "Eye Comfort" units of 300-watt size to provide about 30 f.c. of indirect illumination. The two private offices in the background have 500-watt units, and provide 50 f.c. Drafting room workers were also included, with an average intensity of 50 f.c. in their department.*

YOUR PROFIT IS INSURED

WHEN YOU INSTALL A SANGAMO TIME-SWITCH

VSW TIME-SWITCH

Dependable, continuous operation during current interruptions is assured by the ten-hour carryover feature of this Form VSW synchronous time-switch.

Proper contact pressure is of vital importance to the satisfactory operation of mechanical contacts in time-switches. The contact spring-tension inspection is one of the many rigid tests Sangamo Time-Switches must pass. Thus, this and many other exhaustive inspections, together with correct basic design, insure your profit against "free" service calls when you install a Sangamo Time-Switch.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD · ILLINOIS

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Estimating

Any Questions?

This department presents experience data on estimating—items you can cut out and put into your cost file for later guidance. We will be glad to publish similar data from you—and to pay for it.

Meanwhile, what about questions? If you are looking for experience on some particular operation, say so. We will try to get you the answer from other contractors.

WHAT MARKUP FOR OVERHEAD?

Every estimator finally gets to the point where total costs of material, labor and job expense have been determined, and the estimate now needs only the final markup to cover overhead and profit. The estimate may cover a $100 job or one running $30,000. So the question arises—what should be the overhead markup for jobs of various size?

It is generally agreed that the contractor's overhead, in terms of percentage, decreases as the volume of business increases. However the actual percentage ratio will vary according to the operating efficiency of the individual firm. So with overhead markup varying as to size of job, also as to total amount of business done per year, and as to actual operating efficiency, it becomes a rather complicated situation to cover all types of firms.

An approximate overhead table which simplifies job overhead has been developed by the National Electrical Contractors Association. There is an overhead index table for firms with annual sales from $25,000 to $300,000, and average overhead percentages of 47 per cent to 14 per cent on prime cost. By selecting the correct annual sales bracket and actual overhead, an index letter becomes the guide to use with the following job-overhead finding chart.

The job overhead finder works out like this—

For a $150,000 firm, with 25 per cent overhead on cost, this suggests an overhead of 28 per cent on a $250 job, 42 per cent on a $50 job, and 17 per cent on a $10,000 job.

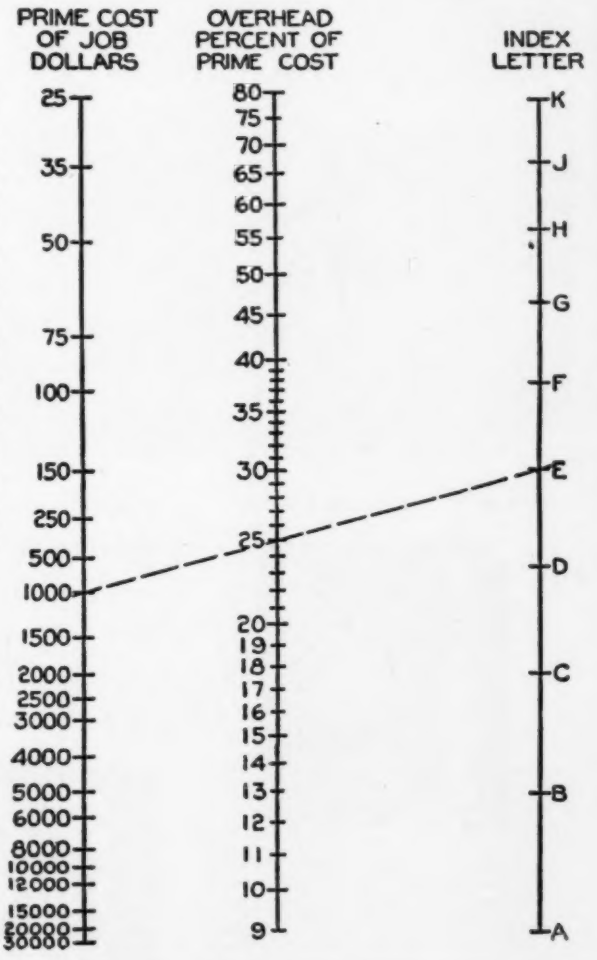
For a $40,000 firm with 35 per cent overhead on cost, this suggests an overhead of 34 per cent on a $250 job, 51 per cent on a $50 job and 25 per cent on a $2,500 job.

INDEX TABLE

Total Annual Sales

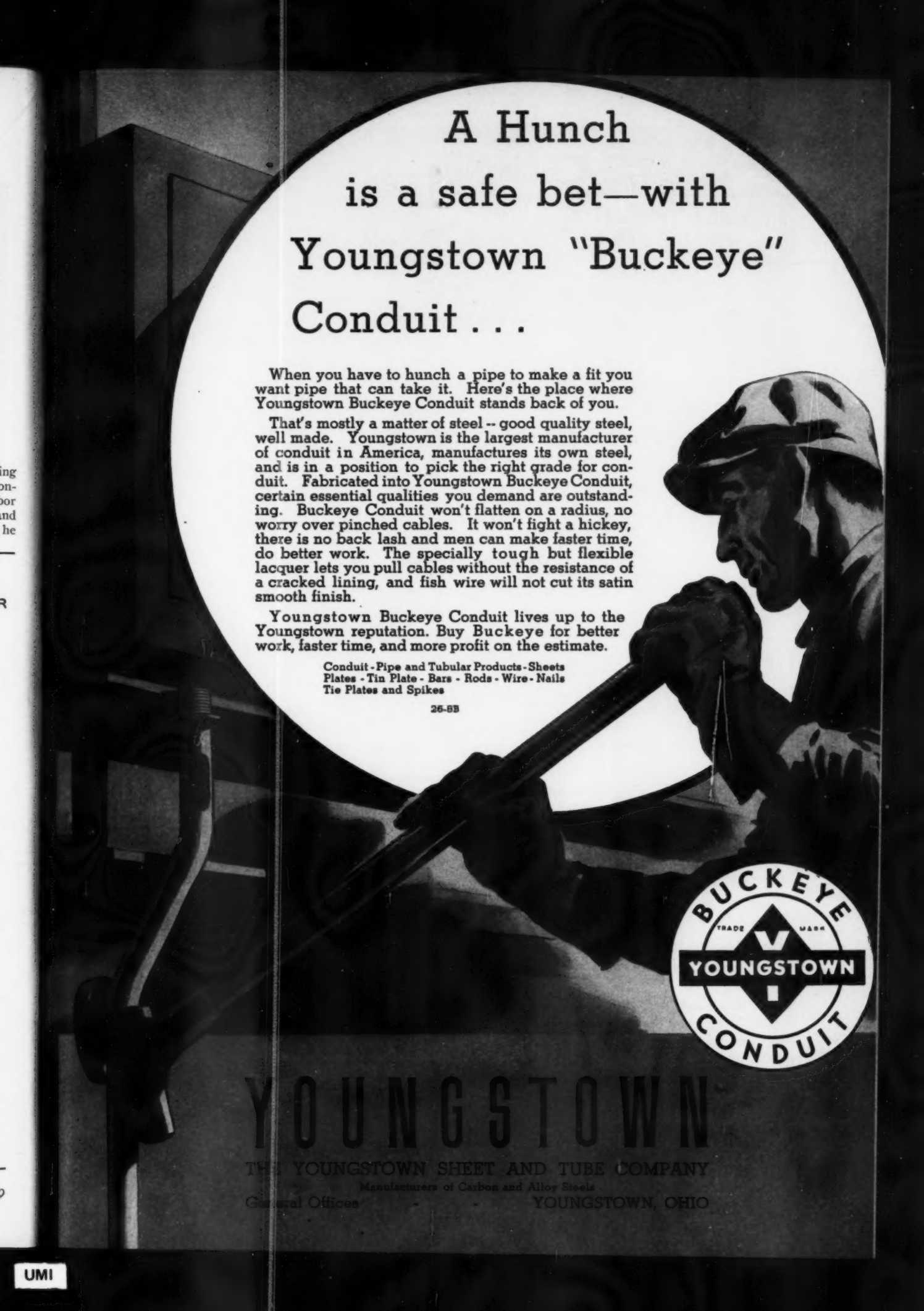
$25,000	$40,000	$60,000	$100,000	$150,000	$200,000	$300,000	
Average Overhead — Percentage of Prime Cost							Index Letter
					14	14	A
			18	17	17	16	B
	24	22	21	20	19	18	C
28	26	25	23	22	21	21	D
31	29	28	26	25	24	23	E
34	32	31	28	27	26	25	F
37	35	33	31	30	29	28	G
41	38	36	34	32	31	30	H
44	41	39	36	34	33	32	J
47	44	42	39	37	36		K

FIND *in the index table the index letter corresponding to your total annual sales and average overhead, computed as a percentage of prime cost. Lay a straight-edge across the chart from the index letter at the right to the point on the left line corresponding to the prime cost of the job. The point at which the straight-edge intersects the middle line indicates the percentage of the prime cost to be added for overhead. To this total the desired percentage of profits must be added.*



COSTS ON LIGHTING EQUIPMENT

During the installation of a lighting system in a warehouse, an eastern contractor made a time study of the labor used in mounting the transformers and lighting fixtures. From the data he


A Hunch
is a safe bet—with
Youngstown "Buckeye"
Conduit . . .
When you have to hunch a pipe to make a fit you want pipe that can take it. Here's the place where Youngstown Buckeye Conduit stands back of you.
That's mostly a matter of steel -- good quality steel, well made. Youngstown is the largest manufacturer of conduit in America, manufactures its own steel, and is in a position to pick the right grade for conduit. Fabricated into Youngstown Buckeye Conduit, certain essential qualities you demand are outstanding. Buckeye Conduit won't flatten on a radius, no worry over pinched cables. It won't fight a hickey, there is no back lash and men can make faster time, do better work. The specially tough but flexible lacquer lets you pull cables without the resistance of a cracked lining, and fish wire will not cut its satin smooth finish.
Youngstown Buckeye Conduit lives up to the Youngstown reputation. Buy Buckeye for better work, faster time, and more profit on the estimate.
Conduit - Pipe and Tubular Products - Sheets
Plates - Tin Plate - Bars - Rods - Wire - Nails
Tie Plates and Spikes
26-BB
BUCKEYE
TRADE
MARK
YOUNGSTOWN
CONDUIT
YOUNGSTOWN
THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon and Alloy Steels
General Offices - - YOUNGSTOWN, OHIO

SORGEL
AIR-COOLED
Transformers

for all voltages
up to

13,200 Volts

single phase
and polyphase

SIZES UP TO

600 Kv-a

for indoor installations

without
fire-proof vaults

No oil or liquid of any kind required. No upkeep.

Being Air-Cooled, SORGEL Air-Cooled Transformers can be installed easily and economically in any convenient place inside of buildings, or right where the change of voltage is wanted.

SORGEL ELECTRIC CO.
No. Plankinton Avenue Milwaukee, Wis.

Estimating

[FROM PAGE 52]

had he was able to determine the following labor units: (a) *Hanging a 15 kva single phase air cooled transformer*—includes setting up rigging, hoisting transformer and hanging it on a steel beam by means of L shaped brackets. Total time (.75 m.h. each for 3 men) 2.25 m.h.

(b) *Wiring, assembling, mounting and connecting 300 watt standard RLM fixtures*—includes wiring socket; assembling canopy, reflector, 6" precut stem, and fixture aligner; mounting the assembled unit on the condulet, connecting with solderless connectors and taping the joint.
Total time. .33 m.h. per fixture

COLLECTING COST DATA

In gathering labor cost data for estimating electrical work, we experimented for several years on various methods of keeping accurate records of workmen's time. Today each job foreman keeps a daily record of each man's time distributed by a code over the various types of work involved. This method has worked itself into a card filing system of approximately 500 various and distinct types of electrical work upon which accurate labor data has been compiled.

In gathering data for estimating purposes, the following method was used in order to simplify the charging of time to the various operations on any specific type of work. By using an alphabetical and numerical numbering system which followed a particular type of work, the charging of time was made very simple.

The letter of the symbol designation is usually the initial of the kind of material handled so that it is easily memorized by the foreman. The number usually designates size or some other classification of the material involved.

The following are in part some of the symbols used:

C½—Installing ½ in. and ¾ in. conduit
C3—Installing 3 in. conduit, etc.
EC1—Installing master program clock with four program circuits
EC2—Installing plug board for program control
W12—Pulling, soldering and taping No. 12 RC wire
WC—Drawing in and connecting wiring for a clock and program system which may include No. 12, No. 14 and No. 16 RC conductors in the same conduit
WCR—Drawing in and connecting wires for clock, program and public address systems in the same conduit
R-1—Mounting surface or flush type lighting cabinets, installing panels and fronts
R-2—Telephone and buzzer panels
R-3—Power panels
R-4—Factory built switchboard.

After the job is completed, the data from the daily time report, turned in by the foreman, is tabulated for each operation and filed for future reference in estimating a job of similar type. As each job is completely broken down, certain operations may fit into some new project for which an estimate is being prepared. From the tabulation, cost data cards are made out and classified in a file according to the type of operation by symbol.

Daily Time Sheet No. 5

Date 2-18-39 Boys Dormitory Job No. K2
Foreman Wyzart

NAME	C ½	C2	W12	R1	A1		Total
Wyzart.....	2		4		2		8
Adams.....	8						8
Holly.....	6	2					8
Graham.....				8			8
Schroeder....	4		4				8

Note: A1 is nonproductive and supervisory time.

2-19-39	C ½	C4	A1	EC1	EC2	R4	Total
Wyzart.....			4			4	8
Adams.....	8						8
Holly.....			8				8
Graham.....			8				8
Schroeder....		1		2	5		8
Schilling....						8	8
Spencer.....						8	8
Yaw.....						8	8
McGuire.....						8	8

Although our system may seem complicated, in practice we are receiving fine cooperation from our workmen in keeping track of the various operations. And, because of the day to day report, minor inaccuracies in the distribution of time over the various operation tend to wash themselves out. (*From A. F. Gould, Superintendent, Central Electric Co., Battle Creek, Mich.*)

Close Figuring

R. J. Sanborn of A. L. Franks & Co., in Manchester, N. H., cites a case of remarkably close bidding. When bids were recently announced for wiring the local armory, they ran—$12,648, $12,650, $12,700 and $12,720. You guessed it, the local bid of Franks & Co. was high.

GENERAL CABLE
GENERAL CABLE
GENERAL CABLE
GUARDIAN
BUILDING WIRE
In braided or leaded construction, single, two or three conductors, Guardian is the material to recommend on your Industrial Jobs for power and lighting circuits . . . Sold by Electrical Wholesalers Everywhere.
*Trade-Mark
GENERAL CABLE
General Cable Corporation Sales Offices: ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DETROIT
KANSAS CITY (MO.) • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROME (N. Y.) • ST. LOUIS • SAN FRANCISCO • SEATTLE • WASHINGTON (D. C.)

In the News

NEW YORK CONTRACTORS IN 40th ANNUAL

Contractors of New York State held their 40th annual convention the week of June 19th. They gathered as usual at Higby's Camp on the shore of Big Moose Lake up in the Adirondacks. They had fine weather, a good crowd.

Three days of morning meetings presented a review of present industry conditions. Wm. L. Kranzer spoke for the Wholesalers Association, W. L. Bliven for state inspection, James Lynett on inspection in New York City. Arthur Schanuel reported on the progress of the Adequate Wiring Campaign, C. O. Hull presented the results of NEMA's study of small diameter building wires, Earl Whitehorne urged a forthright policy toward improving local estimating practice and resisting unfair methods of competition by manufacturers, wholesalers and contractors. R. J. Slauer gave a demonstration of the latest developments in lighting.

The increasing opportunity for the contractors in air conditioning was discussed by S. J. O'Brien. Thomas G. Gorman outlined the advantages of group insurance to the contractors and it was announced that a committee has been appointed to work out a basis for taking advantage of the service of the State Insurance Fund. Paul Ferneding reported his experience in publicising the importance of safety through window displays. These displays prepared by the New York Board of Fire Underwriters are available to local groups of contractors. Earl Peak and L. W. Davis talked on the value of active participation in association work and NECA's interest in the state association.

On "Utilities Day" J. W. Carpenter talked on "the perfect contractor dealer" and C. D. Hollister on the "Better Sight" program, J. A. Brooks on electrical operations at the World's Fair. R. V. Clark and H. J. Taillie discussed window decorating ideas, G. W. Allison reported on the Kitchen Modernization Campaign and Henry J. Morton explained the Code changes proposed by the utilities.

Officers elected for the following year were A. Lincoln Bush, chairman; E. G. May, president; S. J. O'Brien and H. A. Warden, vice-presidents; James Burns, treasurer; Herbert Janick, secretary.

NECA MEETING AT HOT SPRINGS, VA.

The NECA Executive Committee meeting meets at Hot Springs, Va., on July 12th to 14th. It will follow two days of sessions of the National Labor Relations Committee under Chairman E. C. Carlson. Reports will be received from the committees busy field man, P. M. Geary, who has covered a large part of the eastern states in the past two months discussing labor policies and labor situations with association members.

NEW YORK ELECTRICAL CONTRACTORS MORALLY CLEARED

Nine of the ten electrical contractors of New York City, who have been under attack by District Attorney Thomas E. Dewey, withdrew their pleas of not guilty and made a technical and conditional plea of guilty. They were fined $500 each on June 15 and received a suspended sentence of the customary indefinite terms. They entered their plea under the first count of the indictment, which charged conspiracy. They denied the more serious charges of conspiracy to cheat and defraud.

Those who pleaded guilty are Frank W. Cooper, secretary, J. G. Livingston Company; Henry Fischbach, president of Fischbach & Moore; John L. Flagg, president, Watson-Flagg Engineering Company; Robert A. Goeller, vice president, Hatzel & Buehler; Arthur S. Henry, vice president, L. K. Comstock & Co.; John T. Kallenberg, president, Watson-Flagg Engineering Company; John G. Livingston, president, J. Livingston & Co.; Frederick W. Lord, president, the Lord Electric Company; and Loran C. McNutt, president, McNutt, Watts & Tankard. Louis Kalischer, president, Louis Kalischer, Inc., of Brooklyn, pleaded not guilty.

In changing their plea, counsel for the contractors made a formal statement before the court. He said, in part—

"These defendants entered a plea of guilty to the substance of the first count of the indictment. They did not admit the opprobrious characterizations which appeared in the phraseology of that count, such as the characterizations that they acted 'corruptly,' fraudulently and employed trade 'bribery.' The defendants expressly disclaimed the truth of such characterizations. That the defendants have been guilty of a restraint of trade in the sense in which the courts have interpreted the statutes is now admitted.

"In the electrical contracting industry, after NRA, a code of fair competition was formulated on the basis of voluntary agreement; and in that code it was sought to give a measure of stabilization to the

"He's at the dangerous age—falls out of his high-chair, an' stuff like that."

WANT NEW BUSINESS?

SELL AUTOMATIC ELECTRIC INTERIOR TELEPHONE SYSTEMS *for* NEW PROFITS

● Right now you are serving scores of concerns whose efficiency can be stepped way up with fast interior telephone facilities. By telling them about the Automatic Electric line, you not only get in on some profitable new business, but you perform a genuine service for them as well.

Your market is as broad as business itself. All offices, shops, factories and residences are good prospects. And right now is an especially good time to push private telephones because business is distinctly communication conscious.

Automatic Electric makes private telephone systems to fit every need. Shown below are four of the many types available. Our field representative in your territory will gladly supply you with literature, prices and discounts, as well as work with you on specific jobs. Talk to him.

INTERCOMS

Common-talking, selective-ringing systems in capacities of two to eleven stations. Beautifully designed and durably constructed for long, faithful service. Operate from dry cells or battery eliminators.

SERV-U-FONES

Attractively priced common-talking systems in capacities of two to ten stations. Conveniently packaged, simple to install. Operate from dry cell batteries.

AUTO-COMS

Deluxe intercom. Systems providing selective talking and selective signaling service for a maximum of ten stations, and up to five connections at one time. No automatic switchboard needed.

P-A-X's

Private Automatic Exchange systems, available in all capacities. Use standard automatic telephones and provide for a variety of special communication services.

These systems are for private service only. They cannot be connected with the public telephone system.

AUTOMATIC ELECTRIC

PRIVATE INTERIOR TELEPHONE SYSTEMS

Distributed by: AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 West Van Buren Street, Chicago, Illinois

Sales and Service Offices in Principal Cities ● In Canada: Canadian Telephones & Supplies, Limited, Toronto

UMI

In the News

[FROM PAGE 56]

elements which affected the estimation of costs and, hence, of price, as well as the relation with and the return to labor.

"A group, of which these defendants were part, gave consideration from time to time to ways and means whereby not only the leaders in the industry, but the small contractors as well, could get a fair share of contracts, and thus remain in business on a basis which would enable them to pay fair wages, do an honest job, protect the safety of the public and keep open the pathway to economic recovery.

"I do not think that any of them intended thereby to break the law or was conscious of so doing; and, although what they did was in fact a technical breach of the law, I cannot think that the day is far distant when some such plan as theirs must be legalized if business is to be conducted according to the principles of co-operative competition, rather than of competition by tooth and claw.

"The financial records of these defendants show that no undue or exorbitant profit was derived by any one of them, and indeed, not a few at times operated even at a loss. In all this situation, there was no element of violence or racketeering."

APPRENTICE INDENTURED TO UNION

The first electrician apprentice to be indentured with a labor union under the Wisconsin Apprentice Indenture Plan, has signed up with Local Union 135, IBEW of LaCrosse, Wisconsin. This is according to a report by Walter F. Simon, supervisor of apprenticeship, Wisconsin Industrial Commission.

On ordinary contracts the apprentice is indentured directly to the employer. In this instance, however, the indenture contract is taken over by the union, which accepts responsibility for procuring employment for the apprentice during the four year indenture period.

A special rider contract is signed by each contractor for whom the apprentice works. Under this arrangement the contractor is still responsible for providing adequate training during the time the apprentice is in his employ. However, he is not required to provide continuous employment for the full indenture period. The union takes the responsibility for procuring steady employment as required by the contract.

WALKER ELECTRICAL CO. ORGANIZATION CHANGED

Walker Electrical Company of Atlanta, for many years one of the leading electrical contracting firms of the East and South and recently also manufacturers of switch and panel boxes, announces reorganization of the company. The Walker Electrical Company has been incorporated as a separate manufacturing business with Ralph M. Walker as president and T. J. Fleischer as vice-president and sales manager.

The contracting business has been transferred to a new company to be known as the White Electrical Construction Company, of which K. D. White will be general manager. Mr. Walker will hold no office in the contracting business and Mr. White will hold no office in the manufacturing business. This is a further expression of the rigid policy which has been maintained by the Walker Electrical Company that the contracting branch could not secure any advantages from the manufacturing branch over other contractors.

PACKAGED WIRING—*Mass production methods for the 300-unit Colonial Village housing project at Clairton, Pa., left no guesswork for the electrical contractor. Wiring materials for each house were delivered on the job in one carton containing the exact wiring materials to fit. Cut-to-size cable, switch boxes, receptacles, switches, chimes and circuit breakers, matched the engineered layout of each house. This eliminated storage and sorting of material on the job. About 2,000 more of these houses are planned for the near future.*

The idea contributes to mass production and low cost, and may well spread in small house developments of this kind. But the electrical contractor should buy these packaged wiring materials himself — and hold his profit.

AUGUST ECKEL JOINS EDITORIAL STAFF

August Eckel has joined the editorial staff of Electrical Contracting as eastern editor. He succeeds Frank J. Seiler. Mr. Eckel was born in New Jersey, and graduated in electrical engineering from Rutgers University. For five years he has been in active contracting work on the staff of W. L. Schoonover & Company, contractors and engineers of Newark, N. J. His responsibilities have given him a full background on modern contracting practice—estimating, getting the contract, securing the labor, laying out the job, superintending the work and bringing in the profit. This good experience he now brings to the staff of this paper.

AUGUST ECKEL, *joins Electrical Contracting as new Eastern Editor*

Frank Seiler has transferred to the sales staff and is now selling advertising in this paper and *Wholesaler's Salesman*. His long experience as inspector and contractor in Kansas City and in editorial work will now be applied to helping solve the promotion problems of the manufacturers.

MICHIGAN ELECTRICAL BOARD THREATENED

Charging irregularity in the operations of the Michigan State Electrical Administrative Board, Attorney General Thomas Read has filed a report with Governor Dickinson of an investigation into the Board's activities and asks the resignation of the members of the Board. The Board consists of C. W. Spain and James G. Spaulding of Detroit; L. P. Dendel of Lansing; James Kelley of Jackson and Charles Crozier of Battle Creek together with Chief Inspector A. T. Babbitt.

Members of the Board flatly deny the charges, characterize Read's report as ridiculous and claim that the principal charges are legal sharpshooting at the accounting methods which were set up for them by state accountants and have no bearing on the honesty and integrity of the Board or its staff.

The Michigan Electrical Administrative

CEILING PULL SWITCHES

These heavy-duty switches carry the load of responsibility for right-working industrial lighting.

Their mechanical and electrical parts have the extra metal—and extra *durable* metal—to function and *last* under hard use.

Their designs are the outgrowth of 49 years of specialized switchmaking to industrial standards.

***Features:* No. 5020-BW (upper left); new back-wired type. Wires are connected to contacts on back of base. Has 3¼" outlet box cover for conduit work.**

No. 5020 (lower right); same as No. 5020-BW, except designed for top-wiring instead of back-wiring.

No. 3731 (upper right), is for Type C lamps; 20 Ampere "T" rating. Regularly furnished with Bakelite Switch cover.

No. 3742-BCS (lower left), has side pull cord, Bakelite cover, and slots in the porcelain base, for open wiring.

This complete line includes all regular switch connections, with a choice of metal or Bakelite switch covers, side or bottom pull cord; . . . ask for *complete listings.*

SOLD THROUGH YOUR ELECTRICAL WHOLESALER

HART & HEGEMAN DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

UMI

Start

that Refrigerator

in a Jiffy!

● **Where refrigerator breakdowns are due to wornout or abused capacitors, servicing is easy. Just use these two new aids . . .**

EMERGENCY UNIT

Handy, universal, multi-section capacitor provides values from 17½ to 152½ mfd. simply by plugging in corresponding leads. Replace later, at your convenience, with standard exact duplicate replacement. Gets refrigerator going pronto!—and that's what counts in such servicing. Also minimizes your required stock.

CAPACITOR SELECTOR

In the absence of other dependable data on capacitor required, use this inexpensive instrument. Indicates safe and correct capacity for any motor. No guesswork. No fumbling. No comebacks.

Ask Local Jobber . . .

Get descriptive literature. Better yet, get the handy kit—capacitor selector and two emergency units—and render jiffy service to your refrigerator owners.

AEROVOX

CORPORATION

NEW BEDFORD, MASS.

IN CANADA: AEROVOX CANADA Limited Hamilton, Ont.

In the News

[FROM PAGE 58]

Board is non-political and members serve without compensation. They were chosen by former Governor Murphy on the advice of the industry organization which they represent, utilities, contractors, labor, inspectors, and insurance companies. The work of the Board, which has become nationally famous in the electrical industry, included state-wide electrical inspection and electrical contractor and journeymen's licensing.

ADEQUATE WIRING PROGRESS

Further detail telling of the steady progress of the Adequate Wiring Campaign comes in this month from—

Pennsylvania—The first A/W certificate in Mid-Western Pennsylvania was recently presented in New Castle.

Chicago, Ill.—Several speculative builders are now allowing $240 instead of the usual $125 for wiring a $6000 house, in order to conform to A/W standards.

Greenville, Ohio—Now certifying adequate wiring installations. The territory includes Randolph and part of Wayne counties in Indiana and parts of four counties in Ohio.

Dallas, Tex.—A canvass is being made of 1000 houses now under construction to demonstrate adequate wiring.

DOUBLE WIRING FOR FLUORESCENTS

Louisville electrical contractors, cooperating with other industry groups through the Electric Clearing House of Louisville, have adopted a rule requiring wiring systems and circuits for fluorescent tube lighting to be designed for double the rating wattage of the lamp.

This rule, which has been voluntarily adopted by local contractors, compensates for additional current required by auxiliary losses and low power factor.

NEW NECA CHAPTERS

During the month of June NECA has issued charters to four new Chapters in

Philadelphia—with 22 members
Dallas—with 14 members
Spokane—with 6 members
Montgomery—with 6 members.

Besides the new Montgomery Chapter, 14 additional members in Alabama have been accepted in the past month and 5 new members from Jackson, Miss. Since January 1st over 240 new members have been approved for membership. Fieldman J. H. Dyer is now working in Oklahoma and his schedule will take him during the next two months through the principal cities of Texas and Louisiana.

TWO NICKLES A DAY

At the Edison Electric Institute convention in New York, June 6, H. E. Dexter, vice-president, Central Hudson Gas and Electric Company, Poughkeepsie, talked about small customers. He is selling what he calls a small consumers electric kitchen to families on the farm for $122.50. It consists of a small refrigerator, a roaster, a grill and an electrified hot water kettle. It costs the customer two nickles a day, which she deposits in a meter that cuts off the service if not paid for. This company already has collected more than 3,000,000 nickles for this kind of service.

Mr. Dexter believes that a large expansion is coming in the rural sections, where power is now available and little used, if electrical men will come down to present standards of usage. In other words, he says, if a family is accustomed to hot water in kettles full, give it to them electrically, and let them develop the desire for more water as the next step.

COMING MEETINGS

Illuminating Engineering Society—Annual Convention, San Francisco, Calif., August 21–25.

International Association of Electrical Inspectors—Northwestern and Southwestern Sections Joint meeting, Empire Hotel, San Francisco, Calif., August 14–16; Western Section, Hamilton, Ont., Sept. 11–15; Southern Section, Asheville, N. C., Sept. 18–22; Eastern Section, Providence, R. I., Oct. 2–6.

National Electrical Contractors Association—Annual Convention, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 9–12.

National Electrical Manufacturers Association—Annual Conference, Palmer House, Chicago, Oct. 23–27.

IF THEY BUILD AGAIN

A recent survey made by the First Federal Surveys and Loan Association of Salt Lake City found out what changes recent builders of homes in that city would make if they were to build the house again—

21 per cent said they would have more outlets in the living room.

8½ per cent want more outlets in the dining room.

15½ per cent would add a light over the sink.

8½ per cent want more outlets in the dining room.

15½ per cent would add a light over the sink.

8½ per cent want more outlets in the kitchen.

2 per cent want a kitchen ventilating fan.

Out of 126 homes built in a recent period, the local electrical league helped with the plans of 39, promoting the adequate wiring idea. Thirteen received an AW certificate. The rest left out some features that denied them the OK.

CODE MEETING IN NOVEMBER

Wide interest in the proposed Code changes has given unusual importance to the coming meeting of the NFPA Electrical Committee, where the eight power company proposals will be discussed.

A. R. Small, president of NFPA, has just announced that after a check up with the membership, the date for this meeting has been set for November 20th. The place will be Haddon Hall, Atlantic City.

Book on Arc Welding.

"Arc Welding in Design, Manufacture and Construction" issued by the James F. Lincoln Arc Welding Foundation, presents 109 studies of welding experience in the automotive, aircraft, railroad, watercraft, structural, furniture, containers, machinery and jig and fixture fields. These studies are the outstanding papers of the recent $200,000 Award Program of the Foundation. They offer data of value in adapting eelectric welding to industrial processes. Book is 6 by 9 in size, 1408 pages. Price $1.50. Sold by James F. Lincoln Arc Welding Foundation, P.O. Box 5728, Cleveland, Ohio.

MANUFACTURERS NEWS

Westinghouse Appointments

Herbert H. Rogge has been appointed manager of the Westinghouse agency sales department. He was formerly manager of the syndicate division of the Westinghouse Electric International Company. Mr. Rogge's headquarters are now in Pittsburgh.

Robert A. Neal has been made manager of the switchgear division of the Westinghouse Electric & Manufacturing Co. He was formerly assistant to vice-president.

•

Cutler-Hammer, Inc. of Milwaukee has announced the appointment of G. S. Crane to vice-president in charge of sales and engineering. In addition to his sales responsibilities, Mr. Crane now assumes supervision of all of the Development Work for the company and also assumes executive control of the Engineering and Drafting Departments as well as the Patent Department.

•

United States Rubber Co. has moved its Detroit sales branch from East Jefferson Avenue to 5850 Cass Avenue.

A. N. Martinson, formerly manager of the Pittsburgh office of General Electric Vapor Lamp Co., has been transferred to the Hoboken office, to take charge of Hoboken district sales. His duties in Pittsburgh will be taken over by M. J. Rudman of the Pittsburgh office.

•

Wheeler Reflector Company of Boston announces the appointment of the following direct factory representatives in the Pacific Coast area:—Nicholas & Cook, 1063 Howard St., San Francisco, J. G. Pomeroy Co., 823 East Third St., Los Angeles, and E. A. Olsen, 166 Jackson St., Seattle.

•

Van Dorn Electric Tool Co. of Towson, Md., has opened a new service station at 605 McCarter Highway, Newark, N. J. This office is in charge of Harry Bullock, who has recently been transferred from the factory at Towson.

•

Paranite Wire and Cable Corp. of Jonesboro, Ind. has just purchased the Hoosier Stove Works factory property in Marion, Ind. Approximately $75,000 will be spent in remodeling and reconditioning this old plant, which will be operated as an addition to the Paranite Works in Jonesboro.

•

Carboloy Company, Inc. has opened its new $750,000 plant and general offices in Detroit, Mich. It embraces a total area of 121,750 square feet and combines all manufacturing facilities formerly divided among Carboloy plants in Cleveland, Detroit and Stamford.

•

Independent Pneumatic Tool Co. recently opened a new branch office at 1544 Broadway, Denver, Colo. C. A. Turnquist is in charge of this office.

•

Viking Air Conditioning Corporation announces the appointment of A. W. Lehman as manager of the advertising and sales promotion departments. He will also assist Marion I. Levy, president and W. E. Van Horne, sales manager.

•

R. W. Cramer Company, Inc. of Centerbrook, Conn. has appointed the following representatives: H. C. Lemire, 253 Plymouth Bldg., Minneapolis, Minn.; J. T. Couchman, 308 Mutual Bank Bldg., Indianapolis, Ind.; R. H. Heim, 701 Union Central Bldg., Cincinnati, Ohio; H. F. Darby, Jr., 2019 Ritten House Sq., Philadelphia, Pa.; W. P. Daily, W. P. Daily Co., Farmers Bank Bldg., Pittsburgh, Pa.; Carman Adams Co., 2970 W. Grand Blvd., Detroit, Mich.; and Stearns, Perry & Smith Co., 51 Chardon St., Boston, Mass.

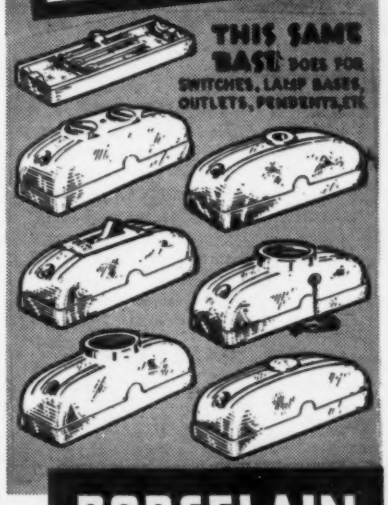
AN ENTIRELY NEW IDEA IN SURFACE WIRING!

HELPS YOU GET MORE JOBS . . .

● One of the principal beauties of Porcelain Products' SURFOLETS (standard base surface wiring devices) is the fact that they open up a big new field in which to sell wiring contracts. They cost you less to begin with, and their unique principle of using a single base for all switches, pendents, outlets, lamp bases, etc., saves you hours of time installing the basic layout, which then is quickly completed by attaching the proper cover. Here are savings you can share with the customer, so you both come out ahead on price and profit! In addition, this new type of wiring . . .

GIVES YOUR CUSTOMER MORE FOR HIS MONEY!

● Actually, in dollar value, the buyer of a SURFOLETS job gets a bargain in the best sense of the word . . . despite paying a lower price, he is assured more outlets than you could otherwise give him, the safest kind of wiring, as well as provision even for expansion later through the use of "blanks" at key points all along the line. Surely, here is your one best means of getting a lot of new business where sales resistance has heretofore run abnormally high . . . and where profits have run proportionately low. Let us send you full details. Write us TODAY!

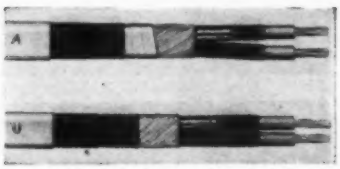


PORCELAIN PRODUCTS, Inc.
FINDLAY OHIO

EQUIPMENT NEWS

Service Entrance Cable

A new improvement has been made in the construction of Type SE service entrance cables. It provides greater flexibility without sacrificing quantity or quality of impregnating material used on individual conductors. Cellophane is wrapped longitudinally over the "black" conductors of each cable. This enables conductors to move independently when severe edgewise bends are made. Both Style "A" and Style "U" can be bent edgewise easily. It prevents impregating material on the "black" conductor from bleeding and discoloring the "red" conductor. It keeps the concentric uninsulated conductor clean and free of compound. General Electric Co., Bridgeport, Conn.

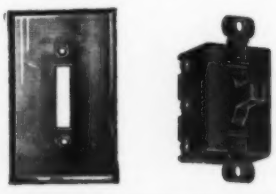


G. E. ENTRANCE CABLE

■

Tumbler Switch

This new flush switch No. 4361 incorporates a double pole, double throw tumbler switch mechanism with three lever positions. One is at each end of throw and one in center. Impossible to switch from one position to the other without stopping at center and again moving lever to second position. Used for two circuit control, two speed motors, permanent and auxiliary lighting. It fits standard deep wall case and is rated 20 amperes, 125 volts; 10 amperes, 250 volts. Because of length of throw necessary for lever, a brass plate, No. 4362, having a longer slot opening is necessary. Arrow-Hart & Hegeman Electric Co., Hartford, Conn.



ARROW-HART & HEGEMAN SWITCH

STERLING SPEED-TROL

Speed Control

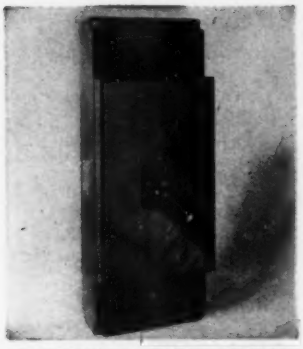
Speed-Trol is an automatic variable speed system. It is 3 hp., 4:1 infinite speed variation, with 30:1 type "B" Slo-Speed gear reduction giving output shaft speeds of 60 to 15 r.p.m., arranged with electric automatic control. Motor is 3 phase, 1800 r.p.m., constant speed. Position of small lever on control box governs speed of output shaft. Lever can also be used as a manual pre-setting device. Totally enclosed and provided with pilot motor arranged to operate handwheel shaft. Units can be furnished in various ratings up to 15 hp. Sterling Electric Motors, Telegraph Rd. at Atlantic Blvd., Los Angeles, Calif.

■

REFLECTORS REFLECTO-DUCT

Reflector

A reflector for fluorescent lighting Reflecto-Duct. Removable cover fastened by two screws. Cover has holes to fasten and bolt auxiliary. Holes for insertion of male loops provided near ends in cover. May be suspended by wire or chain. Made for 48-in., 36-in., 24-in. and 18-in. fluorescent lamps, one and two tube models. Open ends allow continuous trough lighting. Sold unwired, without auxiliaries or sockets. Reflectors, Inc., 3225 Frankford Ave., Philadelphia, Pa.



WESTINGHOUSE CIRCUIT BREAKER

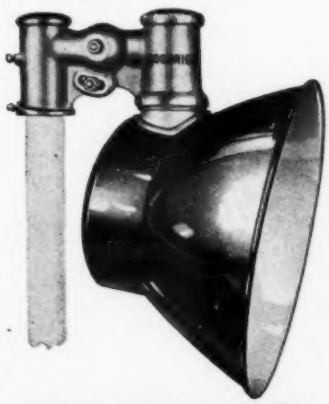
Air Circuit Breaker

Type AB-20 De-ion air circuit breaker is designed for circuit protection of main distribution feeders in central stations, industrial plants or building equipments, where heavy concentration of power requires a breaker of 20,000-ampere interrupting capacity. Available in wire-size ratings of from 70 to 600 amperes and for voltages up to and including 600 volts on a.c. or 250 volts on d.c. Thermal trip elements calibrated with inverse-time characteristics and instantaneous tripping on short circuits where inverse-time-limit characteristics are not desired. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

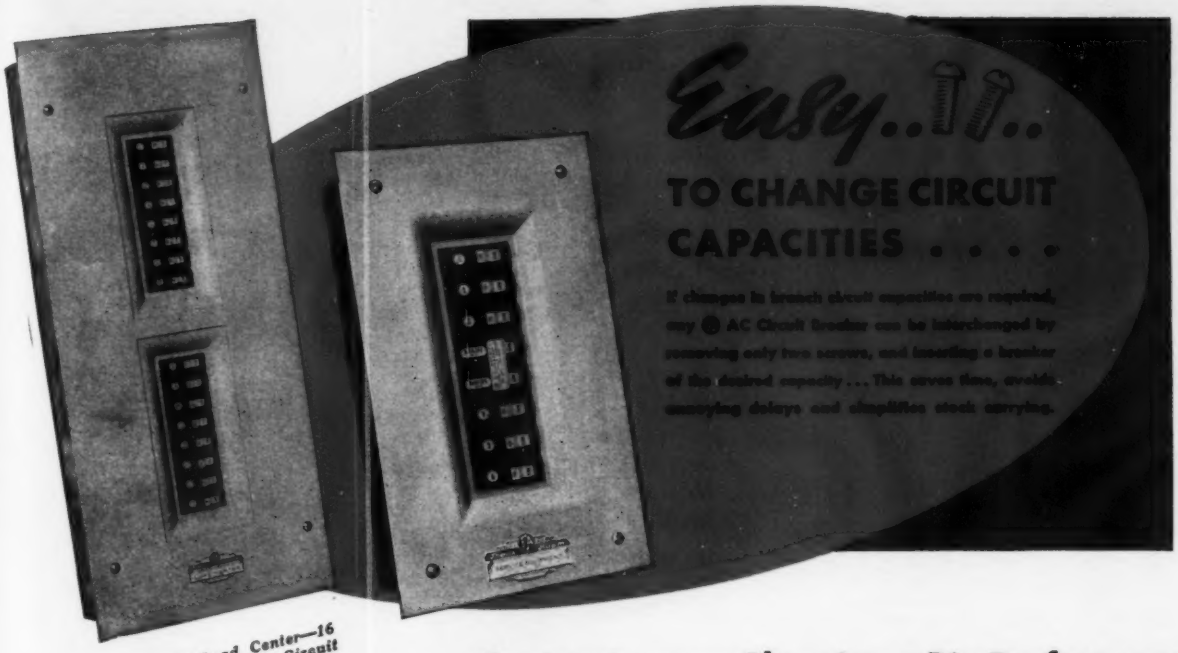
■

Floodlight

This new "Projecto" floodlight is designed to provide a higher degree of light projection and a wide spread of light. Recommended for illuminating grounds, buildings, service stations, parking lots, athletic fields. It is finished in permanent porcelain enamel. May be pole-mounted or attached to walls and other flat surfaces by means of a bracket arm which provides universal adjustment. Both hood and bracket arm are cast aluminum and entire assembly is weatherproof. May also be fitted with water-tight, clear glass lens. Goodrich Electric Co., 2900 N. Oakley Ave., Chicago.



GOODRICH "PROJECTO" FLOODLIGHT



Above: Ⓕ Load Center—16 Single Pole Ⓕ AC Circuit Breaker Branch Circuits

Right: Ⓕ Service Equipment with D. P. 50 Amp. AC Circuit Breaker Main and 6 S. P., AC Circuit Breakers of capacities required

Contractors are Showing a Big Preference for this New Ⓕ AC Circuit Breaker Type

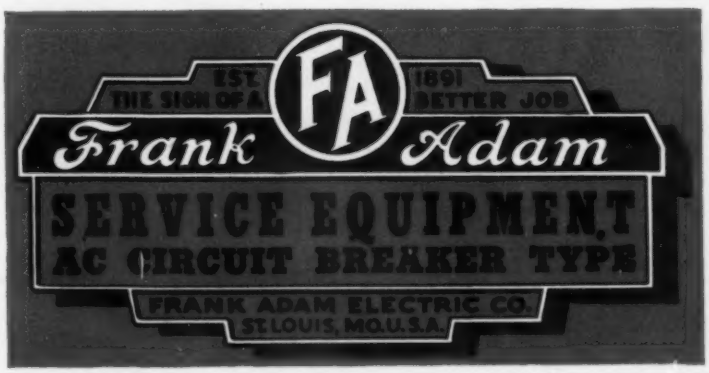
SERVICE EQUIPMENT AND LOAD CENTERS

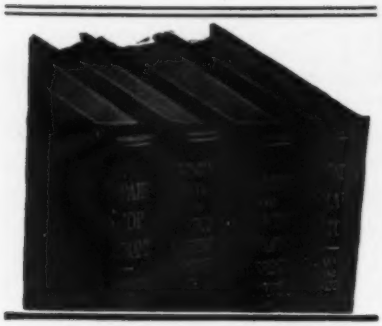
Here's the popular equipment that's going over big with home owners . . . It's easy to sell — easy to install — and has many features of strong appeal:

Positive, automatic protection against short circuits and sustained overloads . . . No needless circuit interruptions when momentary overloads occur . . . No more "groping in the dark" to restore service . . . Merely return the handle to the "ON" position, after the cause of the short circuit has been removed . . . Operates manually, like an ordinary tumbler switch . . . Unusually attractive appearance . . . Fits on the job — easy to install . . . Ample wiring space . . . Priced right!

For 120 volt AC service . . . Capacities: 15, 20, 25, 35 and 50 Amp. . . . Approved by Underwriters' Laboratories . . . Send for New Bulletin No. 58 . . . Frank Adam Electric Company, St. Louis, Mo.

Stocks Near You
FOR IMMEDIATE DELIVERY
With building booming as it is, one of the most important features offered by Ⓕ is your assurance of immediate deliveries from Stock carried by your Distributor. Call him.





NOW- how to repair and rewind all types of motors . . .

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THIS set of books should be on the shelf of every man who ever has to touch a motor for purposes of repairing it or changing it to meet different operating conditions. In shop language and with practical shop methods it covers every step in stripping, rewinding and connecting a.c. and d.c. motors of all kinds.

Do you know how to:

—lay out a wave winding
—test a.c. and d.c. motors to locate grounds, shorts, opens, quickly and positively
—properly record data when stripping armatures so that it will be instantly usable for correct rewinding by yourself or any experienced winder at any time afterward
—determine how many coils can safely be cut out
—lay out single-phase fan motor windings
—change single-phase windings for two- or three-phase operation
—make cross or equalizer connections on lap windings
—lay out frog-leg windings
—handle every step in a rewinding job from the time it comes into the shop until it leaves
—wind stators for tubogenerators
—band high-speed armatures
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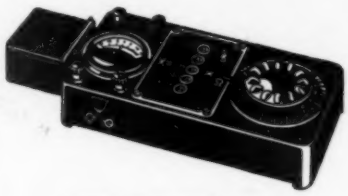
EQUIPMENT NEWS

[FROM PAGE 62]

Measuring Bridge

This measuring bridge, known as "Dwarf", is for measuring resistances in the field, workshop and laboratory. Small dimensions make it convenient to carry around in coat pocket or brief case. Advantages are wide range, simple manipulation, high sensitivity. Bridge comes with ranges from 0.5 to 50,000 ohms and measurements may be made with direct or alternating current as required when measuring resistances of electrolytes. Herman H. Sticht & Company, 27 Park Place, New York.



STICHT MEASURING BRIDGE

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Wiring Devices

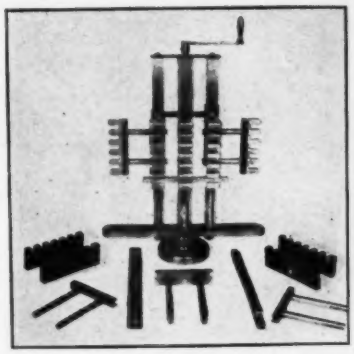
A complete line of weatherproof wiring devices for installations in industrial plants, garages, creameries, distilleries, breweries, loading platforms, residences. May be installed in a single gang switch box or flat face FS fitting. Each device is sealed with cover and plate gaskets. Switches are "T" rated for Type C lamp loads. Outlets have constant tension contacts, gripping both sides of plug cap blades. Ratings are 15 amperes, 125 volts; 10 amperes, 250 volts. Pass & Seymour, Inc., Syracuse, N. Y.

PASS & SEYMOUR WIRING DEVICES

■

Coil Winder and Spreader

A combination coil winding head and spreader which provides an adjustable and collapsible form that is adaptable to operation by hand or by motor drive. The Gesco Coil Winder unit is claimed to: (1) Handle 85 per cent of all round copper coils, or gangs of coils, (2) eliminate coil forms, (3) wind single or gang coils with absolute uniformity, (4) automatically provide a knuckle or nose on coil ends, (5) eliminate further hand or machine pulling. Three simple calibrated adjustments place this winder-spreader ready for making any coil or gang of coils. General Electrical Specialty Co., 184-01 Hillside Ave., Hollis, L. I., N. Y.



GESCO COIL WINDER

■

Probe Light

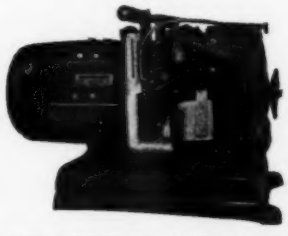
A new probe light, Cat. No. 832, Tiny Lite, that is no larger than a fountain pen. Ideal for those hard to see places. Plug in outlet for instant use. Operates on a.c. or d.c. current. Recommended for use by motor repair men, radio repair men, and others. Available in 2 sizes—110-120 volt with 6 ft. cord and 220 volt with 12 ft. cord. Eagle Electric Mfg. Co., Inc., 59 Hall St., Brooklyn, N. Y.

EAGLE TINY LITE

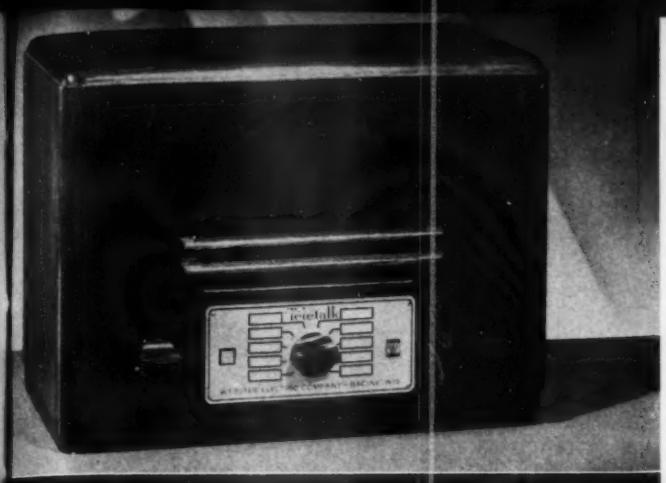
■

Power Plant

Model 19A "Quietlight" is a 350 watts a.c. or 200 watts d.c. power plant. It is 20-in. long by 16-in. wide by 12½-in. high. Runs at 1800 r.p.m. and is powered with a ⅝ h.p. engine driving a four pole, laminated pole generator bolted directly on to engine crankcase. Carries 25 per cent overload continuously. Close voltage regulation. Plant comes with push button starter, ammeter, cutout, charge control and is shielded and filtered. Plant is mounted on sponge rubber mountings. Can be furnished with remote control or full automatic control at additional charge. Controls need not be ordered with plant. Kato Engineering Co., Mankato, Minn.



KATO ENGINEERING "QUIETLIGHT"



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Teletalk

REG. U.S. PAT. OFFICE

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First, every system installation requires a substantial wiring job. This means a profitable bill of materials, not to be overlooked even on the smallest jobs. Second, labor is an equally sizeable item on Teletalk installations. Add to that the substantial profit you realize on Teletalk itself, and you have three good reasons for going after Teletalk business.

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eletalk is available in 5 models and speak- microphones for use in unimportant sta- ns. 3 of the models are illustrated above.

At the top is the Model 110 which has a pacity of 10 stations.

The center illustration shows the Model 2-A which is an enunciator model.

The bottom view shows the Model 224 ich has a capacity of 24 stations.

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BOXES. CABINETS
SWITCH COVERS
ELECTRICAL METALLIC TUBING
E.M.T. BOX CONNECTORS. INTERIOR
TELEPHONE AND INSULATED
STRANDED WIRE. ONLY A
FEW OF THE MATERIALS WHICH
ARE USED IN THE
AVERAGE TELETALK
INSTALLATION

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PERFECT LIGHTING EFFICIENCY FOR COMMERCIAL AND RURAL INSTALLATIONS WITH GOOD PROFITS

Re-Mo-Lite is a newly developed and perfected lighting unit for rural and industrial lighting. It is convenient, comfortable, and safe. The yard light is controlled from a single wire service and any number of switches can be used on the same service. Complete with 2 switches, lag bolts, service screws, and instructions. Here is your opportunity for good income on more lighting jobs. Ask about our free offer.

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- *Simple and speedy to install*
- *Offers great opportunity to meet rural as well as industrial needs*

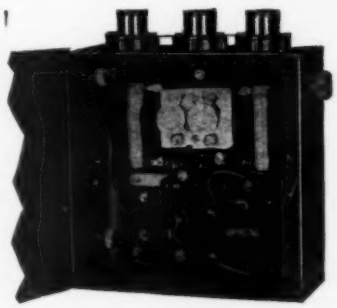
Twentieth
CENTURY ENGINEERING CO.
MANKATO, MINNESOTA

EQUIPMENT NEWS

[FROM PAGE 64]

Bell Ringers

These bell ringers are adapted for operating from direct current mains bells, horns, annunciators, fire alarms, burglar alarms, telephones. Available in three types. Type A consists of wooden box with hinged cover, in which are a number of small glass jars containing liquid electrolyte and special variety of sheet lead. On front is a standard steel box containing cutout, two fuses and set of resistance coils. Number of glass jars depends on number of volts required. Type B uses no liquid and consists of standard steel box conatining cut-out, fuses, resistances and relay. Type C is a combination of Types A and B and is adapted for extra heavy loads. It may deliver ten amperes or more. Beacon Rectifier Co., Hyde Park, Mass.



BEACON D.C. BELL RINGER

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Convenience Outlet

Snapit surface convenience outlets provide for plugging in without marring walls or base-boards. Does away with wires loosely strung around rooms or laid underneath rugs. Eliminates fire hazards. Ready for installation anywhere for use with armored cable, leaded cable, Romex and loom. Metal box, securely fastened, prevents breakage. Size is 4-in. by 2-in. Marks Products Co., Inc., 84 North 9th St., Brooklyn, N. Y.

MARKS SNAPIT OUTLET

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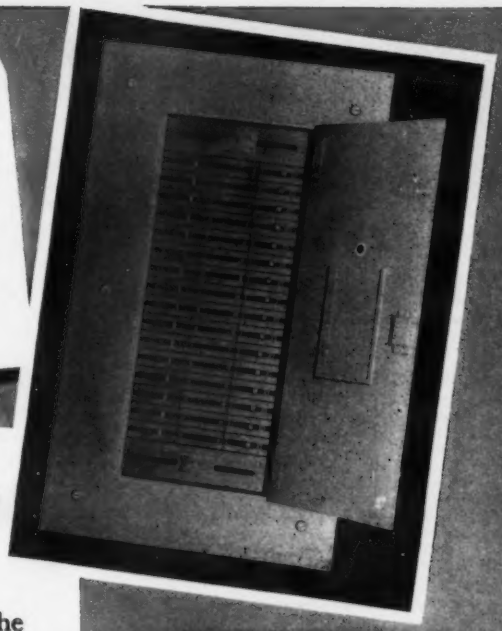
FUSELESS AUTOMATIC
CIRCUIT BREAKERS



to break the Circuit Automatically
when overload occurs"

This specification is becoming standard for the protection of electrical circuits. No longer an experiment, but proved in over 3,000,000 circuits, it is a specification that every modern building designer needs to know about.

Fuseless circuit protection provided by Westinghouse Nofuze equipment protects electrical circuits by means of a bi-metal tripping unit. It automatically disconnects the circuits before overload or short circuit can do harm. There is nothing to replace. Service is restored by moving the Breaker handle . . . so simple and so safe that even a child may operate it.

Suggested specifications and descriptions of applications are in A. I. A. File 131, Architects' and Engineers' Data Book.

It is just good business to at least investigate this equipment before detailing your electrical specifications.

J-60299

WESTINGHOUSE ELECTRIC & MFG. CO.
EAST PITTSBURGH, PA.

Nofuze panelboards give finger-tip control of electrical circuits — Safe, convenient, approved by Underwriters' Laboratories

Nofuze Multi-Breakers for the modern home

Westinghouse Nofuze Protection

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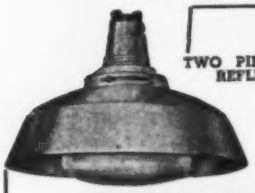

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Multi Reflectors are right for any lighting demand in offices, factories, and shops. Every reflector is especially designed and has special construction features which give best lighting results and which make them serve efficiently for longest periods. You get good looking jobs, satisfied customers, and substantial profits with no after worries. It's a good business move to get acquainted with Multi line—send for our catalog.

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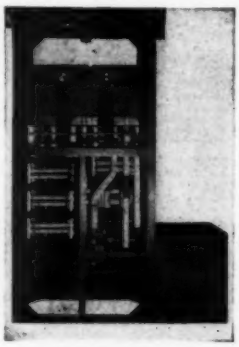
GENERAL SALES AGENTS HATHEWAY AND CO.
220 CHURCH STREET, NEW YORK, N. Y., U. S. A.

EQUIPMENT News

[FROM PAGE 66]

Motor Braking Control

A new three-breaker combination, containing forward reverse and braking, oil circuit breakers. Each breaker is electrically operated with an independent solenoid mechanism. Forward and reverse breakers are arranged to close contact when the solenoid is energized. Breakers are electrically and mechanically interlocked, 25,000 k.v.a. rupturing capacity, 7500 volts, 600 amperes, silver to silver contact, De-ion interrupters, micarta bushings and enclosed construction. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

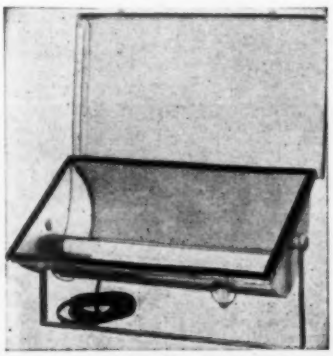


WESTINGHOUSE CONTROL

■

Fluorescent Floodlights

A fluorescent floodlight for outdoor color illumination of buildings, signs and posters. Requires only 15 watts for fluorescent unit to produce as much green light as is possible with a 375-watt incandescent floodlight. Equipped with an 18-inch tubular fluorescent lamp, it has an aluminum trough-type reflector which also serves as a housing. Interior is alzak-processed. Mounted on metal standard with bolts for adjustment of light, unit provides for easy replacement of lamp by a hinged, rubber-gasketed door with clear glass. Six-foot conductor cord is supplied. General Electric Co., Schenectady, N. Y.



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for
INCREASED EARNINGS

Save Time for Other Jobs!

SPEED solderless connections . . . Save time for other jobs . . . Increase earnings.

SOLDERLESS LUGS

Simple. Sturdy. *Seconds* to secure connections — with just a few turns of your wrench, screwdriver or pliers. Proof against extreme pull: V-Wedge wire opening squeezes wires tight *all around* . . . compresses strands, insures full contact!

Save time getting them—from your Electrical Wholesaler.

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Profit by USING

ILLINOIS
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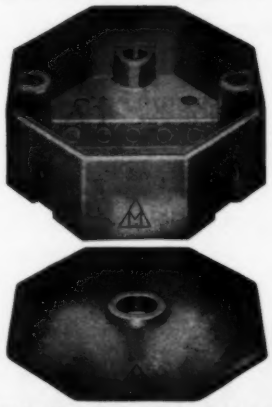
OUTLET BOXES



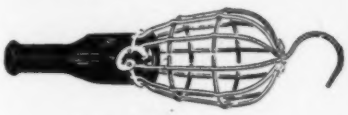
†Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

Contractors who use these products not only establish themselves most securely with their customers but also build their business by making each job a true quality one. Send for bulletin.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

Portable Guard

The New No. 7100 portable guard series is essentially the same as the No. 7000 series, except that a wire collar supplants the flat band at base of cage. Available in 15 different types, with or without reflectors, closed cages, lever or keyless sockets, for all-purpose work. Cage constructed of ten steel wires. It is held to handle by a cam arrangement which makes for easier and faster lamp changing without use of tools. Cam arrangement feature provides several locking stations, making it possible to use cage interchangeably on either rubber or wood handles. McGill Mfg. Co., Valparaiso, Ind.



McGILL PORTABLE GUARD

■

Duplex Receptacle

Twist-Tite duplex receptacle No. 9200 takes any standard parallel blade cap and holds it from pulling out accidentally. After cap is inserted, slight twist to right locks it in. When cap is inserted, without twisting, it pulls out as easily as from any receptacle. Has completely enclosed Bakelite or Ivorylite base and fits standard duplex plates. Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

ARROW-HART & HEGEMAN RECEPTACLE

■

Exhauster

This "Slo-Speed" belt drive exhauster, known as Homilator, is recommended for applications where noise is objectionable. Vibration is eliminated through resilient motor mounting. Other features are floating power, self-aligning pillow blocks and Kisco oiling. The Homilator is for attic home cooling. Available in three sizes and for a.c. and d.c. Kisco Company, Inc., 39th and Chouteau, St. Louis, Mo.

KISCO HOMILATOR

For new and rewiring jobs

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BUILDING WIRE

We manufacture code, intermediate, 30% and super aging.

All approved by the Underwriters Laboratories, Inc. N.E.C.S.

Flame and moisture resistant.
Slick finish for quick and easy pulling.
Long aging rubber.
Uniformly small diameters.
Clean—easy stripping.
Eight clear distinct colors.

ROME PRODUCTS

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SWITCH

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1937 MEAD STREET
RACINE, WISCONSIN

For A. C. loads up to 50 amperes. Furnished in single and double pole types and in either cast iron or sheet steel cases. $18.00 and up. Underwriters' Laboratories approved

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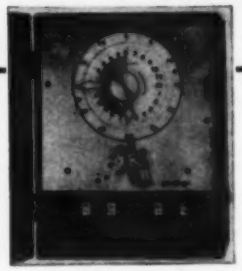
SIGNAL TIMERS



For STARTING AND STOPPING INDUSTRIAL WORK

For MARKING SCHOOL CLASS PERIODS

For SOUNDING MUNICIPAL TIME SIGNALS, ETC.

Furnished with from one to six permanently set signal periods, for any times desired, but more than five minutes apart. Additional signal periods at little added cost. The schedule can be changed at the factory any time a different program is wanted.

$30.00 With addition of *both* a "Manual Control" and "Sunday and Holiday Cutout", $35.00.

AUTOMATIC ELECTRIC MFG. CO.
MANKATO, MINN.

SHERMAN
SPLICING SLEEVES

★ **THREE TYPES**
Cover All Needs

★ **UNIFORM HIGH QUALITY**
Gives True Economy

TINNED (split-connector)
Ample tensile strength. Wire will break before loosening in sleeve when properly soldered. No tendency to overheat. All surfaces smoothly tinned. For round or sector shaped cable. Send for Bulletin No. 20.

(right)
FIGURE EIGHT DOUBLE TUBE
Extra quality electrolytic copper of high conductivity. Seamless and free from burrs. Correct temper. Wide range of sizes. Bulletin No. 20.

(left)
OVAL SINGLE TUBE
High grade electrolytic copper. Free from burrs. Proper temper. Carefully grooved throughout length to prevent buckling outward when twisted. Wide range of sizes. Bulletin No. 20.

H. B. SHERMAN MFG. CO.
Battle Creek Michigan

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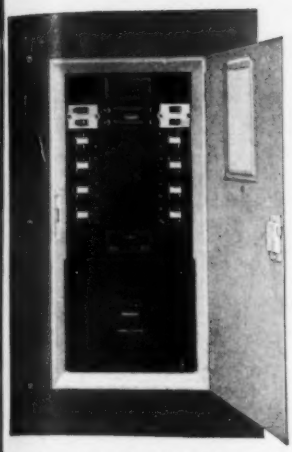

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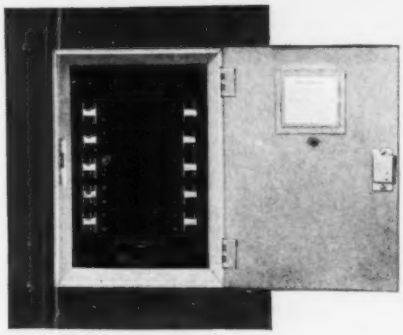

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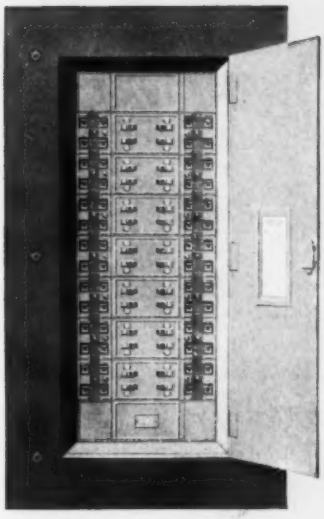

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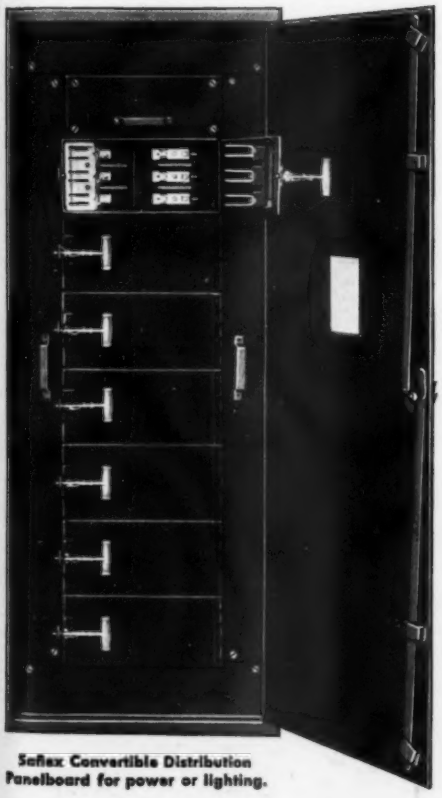

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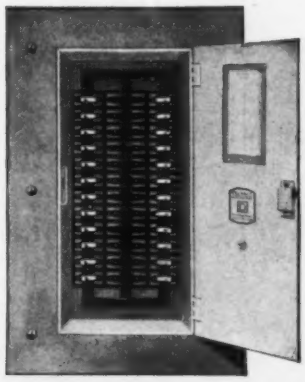
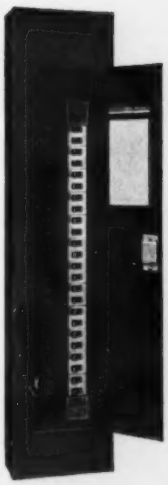


Circuit-breaker Panelboard Type L, quick make, quick break, double break branches.



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